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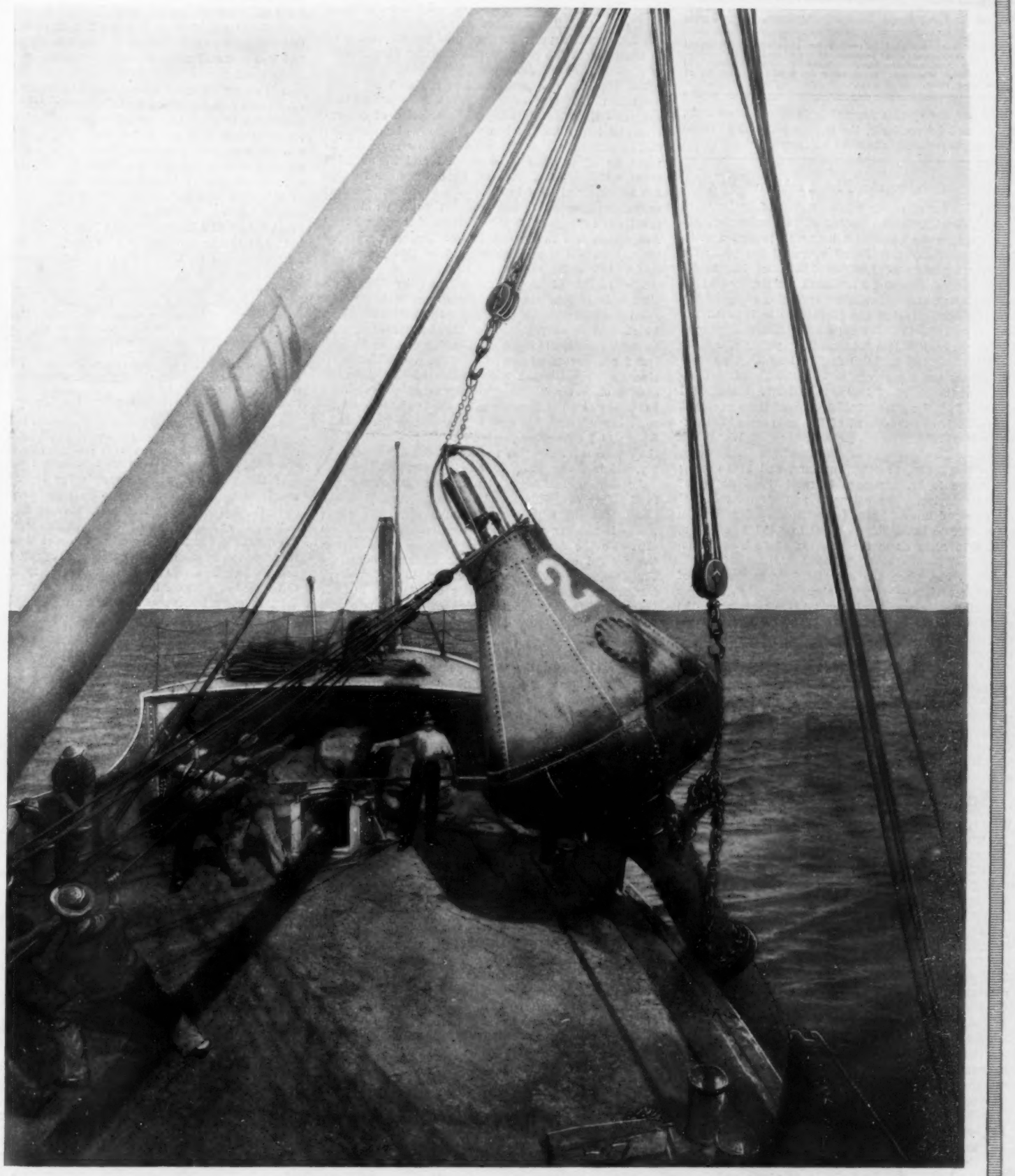

The dangerous work of hauling the enormously large and unwieldy iron buoy over the side of the tender.

WORKING A WHISTLER.—[See page 514.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Solving the Pier Problem

THE recent action of the Board of Estimate of this city, in the matter of pier extension, advances the question a long way toward a satisfactory solution. The Board approved the plans for constructing piers of 1,000 to 1,200 feet length, between Forty-fourth and Fifty-sixth streets, by making the necessary excavation inshore; it also approved the plan for straightening the pierhead line between the Battery and Thirtieth Street; a relocation which would permit the construction between these points of a score of piers from 920 to 1,040 feet in length. These improvements are those suggested by the Terminal Committee of the Board of Estimate and by a State board appointed by Governor Dix. A copy of the report and the resolution of the Board of Estimate have been forwarded to Mr. Stimson, the Secretary of War, with whom the determination of pierhead lines finally rests.

The two plans are complementary, and both are, or will prove to be, necessary to meet the demands of future shipping. The extension and straightening of the pierhead line will give immediate relief, and make it possible to build ships of 900 to 1,000 feet length, without anxiety as to the question of dock accommodation.

Nobody can place any exact limit upon the size of future steamships—provided, always provided, that the deepening of entrance channels keeps pace with the ship's ever-deepening draft. It is now fairly certain that the year 1913 will see the laying down of the keel of the first 1,000-foot ship; and the economic conditions which justify the 1,000-foot ship encourage the shipping people to build one 1,100, 1,200 or even 1,500 feet in length; for the larger the ship the smaller the cost of carrying the individual passenger or a given amount of freight. But when the Secretary of War has sanctioned the pierline extension from the Battery to Thirtieth Street, he will have defined the least navigable width of the Hudson River for all time. Any ship that exceeds 1,040 feet (the length of the longest pier admissible within the new line) must tie up at piers which have secured the needed length by excavating back beyond the shoreline.

Hence the great importance of the Board of Estimate's plan for obtaining possession of the present rather unimportant stretch of piers between Forty-fourth and Fifty-sixth streets, together with sufficient land for the construction of 1,000-foot or even longer piers by excavating back into Manhattan. For it may be taken for granted that the giant ships of the future will ask for docking facilities, not at Boston, New London, or Montauk, not even at South Brooklyn, but at Manhattan; and the city will have failed to learn the lesson of the present *impasse* if it omits to make provision for a growth in the size of ships which is certain to take place.

Hence, we suggest that while the city is making the necessary purchases of land in the uptown district, it acquire the whole depth of the blocks between Forty-fourth and Fifty-sixth streets, from Twelfth to Eleventh avennes. This would give accommodation for piers 1,500 feet deep, and for the terminal buildings and marginal elevated road, proposed by Dock Commissioner Tomkins.

The piers would be built in numbers and length, only as needed, and it might be two decades or more before the 1,500-foot ship appeared; but he would be a bold prophet who, turning from the 100 per cent increase of length of the past quarter of a century would deny a 50 per cent increase in the quarter of a century to come.

An Admirable Civic Body

IN fulfilling its avowed purpose of recording the world's progress in scientific knowledge and industrial achievement, the SCIENTIFIC AMERICAN has always given much attention to important engineering works of a municipal character. In the course of our investigations, we have noticed how frequently—we had almost said invariably—our study of large municipal problems has brought us sooner or later, and generally sooner than later, into touch with that admirable body, the Merchants' Association of New York.

Which means, of course, that this body of high-minded citizens for many years past has been doing well its work of safeguarding and promoting the interests of the commercial capitol of the western hemisphere. The Association has been both watchdog and worker. It has always been the terror of the spoilsman, whether he was represented by a powerful political law-juggling clique at Albany, by the dishonest contractor for city works of great magnitude, or by the innumerable petty larceny grafters which follow in the train of the generals and captains in the work of municipal spoliation.

The Merchants' Association has rendered its many services to the city so quietly, that we believe the average citizen has no adequate conception of the extent and importance of the work, both of prohibition and promotion, which it has done. Its membership is made up of well-known, influential and high-minded citizens of New York. In every big civic question which has arisen, or at least in those of a scientific, technical or constructive character, such as come within the province of this journal, the attitude of the Merchants' Association has invariably, if our memory serves us right, been the one which seemed to this journal to be for the best interests of the city.

The record of work accomplished by the Association is a long one, and its successes have been notable. There comes to our mind the winning fight, which was so ably waged by this body against that attempted colossal fraud of the Ramapo watershed. But for the work of the Association, a band of rapacious politicians would have committed this city to a system of water supply, the sources of which would have been held for ransom by the members of the band themselves. The scheme was exposed and frustrated, and out of this agitation has ultimately come the construction of the magnificent Catskill waters supply, which is soon to be at the city's disposal.

Another successful agitation was that which secured, in the face of political and interested opposition, the passage of the Pennsylvania tunnel franchise, which to-day is yielding a considerable annual revenue to the city. To the Association is due, in no small degree, the federal appropriation of six million dollars for the dredging of the 40-foot channel into New York harbor, which is now practically completed. But for this channel, the modern liners of vast length and draft which now enter this harbor must have sought some other port of call.

Not alone was the Association the original moving power which led to the enlargement of the Erie Canal; but it was largely instrumental in securing the canal terminals, which are necessary if the city is to reap the benefit of that great work. Moreover, the Association had much to do with the passage of the legislation providing for the elevated freight tracks along the Hudson River waterfront, associated with suitable terminals, at which all railroads could deliver their freight.

In this connection, mention should be made of the protective influence of the Association, as shown in their successful efforts to induce the federal government and the State of New York to join in a suit to prevent the State of New Jersey from discharging the sewage of the Passaic Valley into New York harbor.

The Merchants' Association realizes that the approaching construction of the Panama and Erie canals, and the unparalleled growth of the city in population, wealth and trade, to say nothing of the active rivalry of other seaports, calls for a proportionate increase of activity in so meeting the new conditions as to promote the best interests of the city. The Association wishes to broaden the field of its operations, and it is looking for the more active support of the prominent and influential citizens of New York. One of the encouraging signs of the time is the increasing recognition of the demands of citizenship upon the voluntary services of the individual citizen. Within the ranks of the Merchants' Association he will find both the organization and the means for giving practical expression to his desire for the political and commercial improvement of the city.

Selling Patented Articles

THE recent decision of the United States Supreme Court in the Dick Mimeograph Patent Case, and the widely quoted dissenting opinion of Chief Justice White from this decision is the chief occasion for the present passion to change the patent system. Almost everybody who read Chief Justice White's dissenting opinion was imbued with the idea that the defendant, Henry, who made the ink that caused all the trouble, was held as a patent infringer, because Miss Skou, the girl who owned the mimeograph which was misused, bought some of Henry's ink and used it without poor Henry's ever knowing anything about it.

The truth is that Dick's mimeograph was sold only upon condition that it be used exclusively with Dick's ink. Henry, knowing all about this license restriction, and with the expectation and intention that his ink would be used for the purpose of violating this restriction—to which Miss Skou, as Henry well knew, had expressly assented when she acquired the mimeograph—supplied Miss Skou with the means of accomplishing this wrongful act. Indeed, the courts below expressly found that Henry, far from acting with that innocence which has captured the popular fancy, had deliberately and knowingly instigated Miss Skou to this wrongful act, and had even instructed her that if she would pour Henry's ink into Dick's can, and then throw away Henry's can, so that no one would find it, she would never be caught violating the license restriction!

It is a peculiarity of patented articles, as many manufacturers and inventors explained to a congressional committee as soon as they had the chance, that they are essentially new and unfamiliar. The patent owner can control them only during the seventeen years that the patent endures. All the resources of past experience in advanced salesmanship are none too adequate to market a new and unfamiliar patented article, the use of which may mean a decided change in the personal habits of a large portion of the public.

In the rather colloquially expressed opinion of one authority, who testified before the congressional committee in question:

"The mere invention of merchandise is almost a minor consideration when put up against the selling and marketing of merchandise. There are thousands of inventions in this country which are very valuable indeed, but which can never be commercial possibilities or are not now commercial possibilities because of the selling problems involved. There are big and serious selling problems involved in merchandise, especially patented merchandise. If you are selling shoes, there is a ready and accepted market for shoes, before you manufacture, but when you take a patented article, think what you are up against! You have got to persuade the other man to whom you hope to sell that this is a good thing, something that he has never used before. It may mean a revolution of his habits, or it may be a revolution of something else, and you have got to overcome that resistance."

If the patented article depends for its successful operation upon the use of supplies especially adapted to it, the difficulties are immensely increased. "It may be," explained a member of the Inventor's Guild, "that the article is of such nature that in order that it shall work properly, it shall require very great care in selecting certain conditions of use, certain materials to be used in connection with it. It certainly is a fact, that, in some instances, a man with a market for a good article would be completely destroyed, if he could not insure himself in seeing that it was properly used after it left his hands."

Mr. H. Ward Leonard, a former associate of Mr. Edison's and now a famous electrical inventor on his own account, was asked, when he appeared, whether the self-interest of the customer was a not sufficient substitute for any license restriction. He replied:

"I cannot agree, that that would be sufficient protection to the manufacturer whose sale depends entirely upon the perfect performance universally of the article. I have been a manufacturer long enough to know that there is nothing which so insures your future business of a profit as universally high quality, and it only takes a few cases that are spread abroad by your competitors as to the improper working of an article to have a very serious effect upon your business."

The chief obstacle in the marketing of an untried patented article is always the initial expense of its purchase price. The price, in any sum that fairly compensates the patent owner, is, in many cases, too high to sell the article. To avoid this obstacle, and so far as possible to relieve this additional expense, various plans have been devised, under which the customer pays for the use of the patented article, only after he has actually used it, and then only in strict proportion to the amount of benefit which he derives. Said one witness:

"Suppose a machine is invented for which a manufacturer cannot afford to pay an adequate price outright, but the inventor lets him use it, and agrees that he shall pay the inventor so many cents per hundred articles manufactured on it. That is no burden to the manufacturer, and the inventor in the long run has his return, and if the machine is successful, he participates with the manufacturer in the success of it; but if it were going to be sold outright, the manufacturer would discount all chances and require it to be sold at a very small price."

Under this plan, the customer obtains physical possession of the patented article, together with the right to use it under the conditions of the license, but is not obliged to pay the patent owner anything for the right of use, unless he actually exercises it; and if he uses the patented article at all, he compensates the patent owner strictly in exact proportion to the efficiency of the patented article, and to the benefit that he derived.

Engineering

Crossover Precautions.—The Public Utilities Commission of the State of Connecticut, as a result of its investigation of the Westport crossover accident, has made an order that express trains on the New Haven Railroad must come to a full stop before passing over crossovers which are "not safe for high speed." It was announced in the daily press that the president of the New Haven road has ordered that its No. 10 crossovers on express tracks be replaced, wherever it is possible, by No. 20 crossovers.

For Safer Ships.—The Senate Investigation here and the Lord Mersey Court in England did their work well, and their recommendations, if followed and embodied in legislative acts, will render the recurrence of such a disaster as happened to the "Titanic" impossible. Much depends upon the work of the International Congress, which is soon to meet in London. When its recommendations have been made public, they should be embodied in the laws of all maritime nations, before the lapse of time has weakened the stimulus of the disaster.

Ship-building Activity in Great Britain.—The British and Irish ship-building yards are enjoying an unwonted run of prosperity. At present there are 592 vessels, aggregating 2,366,371 tons, under construction, which represents an increase of 25 per cent over the tonnage of vessels being built last year. The shipyards cannot obtain sufficient men, and they are frequently working over-time and using double shifts. In spite of this activity, new orders are being taken faster than the ships are being completed. Though American operations are on a much smaller scale, it is gratifying to know that our yards are also full of work.

Panama Canal Rates Fixed.—President Taft has fixed the rates for the Panama Canal as follows: Merchant vessels carrying passengers or cargo, $1.20 per net vessel ton. Vessels in ballast without passengers or cargo, 40 per cent less than the rate of toll for vessels with passengers or cargo. For naval vessels other than transports, colliers, hospital ships and supply ships the rate will be 50 cents per displacement ton. American coastwise shipping is exempted from payment of tolls. It should be noted that the rates named in the President's proclamation are practically the same as those which will be enforced at the Suez Canal next year.

British 13.5-inch Gun Bursts.—The recent bursting of a British naval 13.5-inch gun at Shoeburyness will at once bring to mind the controversy which formerly raged over the question of the relative strength of wire-wound as against hooped guns, for we presume that the 13.5-inch piece was one of the new naval weapons which are carried by the latest British dreadnoughts of the "Orion" class. The advocates of wire-wound construction claim, or did claim before the recent improvements in hooped guns, that the wire-wound gun, because of the absolute inspection to which every part of it could be subjected, was proof against the kind of accident which recently happened at the proving ground.

Compression for Sound Ingots.—Benjamin Talbot, of Middlesborough, England, is securing good results with his system of fluid compression for producing sound ingots. During pouring, two ounces of aluminium per ton is added to the fluid steel. The ingot is soaked to give a thicker envelope and secure the desired temperature for compression, which is obtained by reducing it in the blooming mill, a 20 by 24-inch ingot being reduced to 18 by 18 inches. After further treatment in the soaking pit, it is rolled into a bloom which is ready for the mills. Rails rolled from these blooms are characterized by a hard working face, with a harder section behind it, and a somewhat softer center.

World's Longest Arch Bridge Being Built.—Work on the foundations of what, when completed, will be by far the greatest arch bridge in existence, is being actively prosecuted at Hell Gate, in the East River. The bridge, which has been designed by Gustav Lindenthal, will contain a four-track, steel, arch span of one thousand feet. It will be capable of carrying, with a wide margin of safety, four of the heaviest of our modern freight trains abreast at the same time. Including its approaches, the structure will be some three miles in length. It will serve to connect the New Haven and Pennsylvania systems by way of Long Island, the Pennsylvania East River tunnel and the Pennsylvania freight ferry across the upper bay.

Railroads and the Steel Trade.—Recent published statistics show what a vast amount of steel is demanded by the railroad system of the country for track and rolling stock. Thus, a single system, the New York Central, has sent out inquiries for between ten thousand and fifteen thousand steel freight cars. The United States Steel Corporation is asking for 3,000 cars, the Harriman lines for 5,000, and the total inquiry is for about 30,000 cars. There is a corresponding demand for steel rails, the Pennsylvania Railroad alone calling for nearly 200,000 tons for delivery in 1913; and it is believed that the demand in the United States, coupled with expected large orders from abroad, will bring the orders for rails for 1913 up to the enormous total of three million tons.

Science

The Tsangpo-Brahmaputra Question was left unsettled by the recent British expedition against the Abors, although a certain amount of geographical work was done in that connection. Now it is announced that another attempt will be made this winter to penetrate the unexplored region of the Upper Dihong, i. e., the portion of the great river of Tibet and Assam that is still a dotted line on our maps. The leader of the party will be Major Gunter, R.E., who will be accompanied by a detachment of military police.

The Bryant Expedition to Labrador.—Mr. H. C. Bryant, president of the Geographical Society of Philadelphia, recently spent three months in an exploration of the St. Augustine River, which enters the Gulf of St. Lawrence in Canadian Labrador. The river was ascended to its source, 141 miles, partly through country never before visited by white men. Only the desertion of the Indian guides, and an accident to one of the party, prevented Mr. Bryant from continuing his journey northward to Hamilton Inlet. Valuable entomological, geological, and photographic collections were secured.

The Livingstone Centenary.—The centenary of the birth of David Livingstone will be celebrated next March by the geographers of the world. The Royal Geographical Society, in London, will hold a special meeting on March 17th, when Sir Harry Johnston, the great African explorer and administrator, will deliver an address, and it is expected that Sir John Kirk, the only surviving companion of Livingstone on his expedition of 1858–64, will be present. The same society will hold an exhibition of Livingstone relics. Later in the month Livingstone will be commemorated in his native Scotland by a special meeting of the Royal Scottish Geographical Society, also to be addressed by Sir Harry Johnston.

An Agricultural Department in China.—The Republic of China has established a Department of Agriculture and Forestry on modern lines, and this institution has begun publishing an agricultural journal (all in Chinese), which appears three times a month. It is understood that a national meteorological service will be established as a branch of this department, and that it will be under the direction of Dr. Hing Kwai Fung, who was educated at Cornell University, and who for a year past has been attached to the Bureau of Plant Industry in Washington as an agricultural expert. Dr. Fung has started for China by way of Europe, where he will make a round of visits to meteorological observatories.

Dew Ponds.—Mr. Edward Martin, who has now spent some years in investigating the mysterious dew-ponds of the English downs (see SCIENTIFIC AMERICAN, August 6th, 1910, p. 100), made a progress report on this subject at the last meeting of the British Association. He stated that he "sees in fogs and mists the factor which tends to keep alive the best-made of the ponds. The precipitation of mist into the ponds, aided perhaps by silent discharges of electricity, and the entanglement of mist-laden salt-dust in the hollows in which the ponds lie, are believed to be the means by which some ponds maintain a supply of water all through the year, in spite of the great draught made upon them by numerous cattle."

A Signaling Anemometer.—The West and South Clare Light Railway, in western Ireland, has occasionally had its trains derailed by high winds from the Atlantic Ocean. In order to obtain timely notice of the occurrence of such winds the company has borrowed from the British Meteorological Office a pressure tube anemometer, which is installed at Quilty station in charge of the station-master. This anemometer is fitted with an electrical attachment, devised in the Meteorological Office, which gives a signal when the wind reaches a certain strength. The first signal is given for a wind velocity of 65 miles an hour; under such conditions ballast is placed on the trains to increase their stability. If the wind rises to 85 miles an hour a second signal is given, and traffic is then suspended.

The Variability of Solar Radiation appears to have a range of from 5 to 10 per cent, with an irregular period of from 5 to 10 days. That these fluctuations as measured within the earth's atmosphere represent actual changes in the solar output, and are not merely the result of local conditions of observation, can be determined only by simultaneous observations at two or more places on the earth. Some two years ago the Smithsonian Institution planned taking a series of observations of the solar radiation at some point in Mexico for comparison with simultaneous observations on Mt. Wilson, Cal. On account of the disturbed political conditions in Mexico this plan was abandoned in favor of a station in Algeria, where observations were made in 1911 by Mr. C. G. Abbot, director of the Smithsonian astrophysical observatory. As the weather was not very favorable, Mr. Abbot decided to carry out a second series of observations at the same place during the present year, and these have now been completed. Although the results have not been announced, it is believed that they will furnish more definite information than has ever before been available on the subject of solar variation.

Aeronautics

An Aerial Maxim at Aldershot.—Among the practical work being carried out by the Royal Flying Corps at Aldershot is an extensive series of experiments with a Maxim gun fitted to a biplane of the B.E. type. Canvas targets representing aeroplanes have been placed on *terra firma* and tests made by firing at them from heights up to 3,000 feet.

Operating a Parachute by Compressed Air.—In patent No. 1,043,836, William A. Hodge presents in connection with a parachute, and a compressed-air reservoir adapted to be secured to the aeronaut, a valve controlled nozzle for the reservoir which is arranged to discharge to the parachute, means being provided for releasing the parachute and for opening the nozzle valve so that the compressed air can open the parachute.

Burning of the Military Aviation Establishment at Sebastopol.—A disastrous fire occurred not long since which resulted in the destruction of a large amount of aeronautic material at the military aviation establishment at Sebastopol. Russia. The fire appears to have been caused by an explosion of gasoline, and this set fire to the machine shops in the first place, then the fire spread to the rest of the buildings on the grounds and three hangars were thus consumed, along with four aeroplanes, three automobiles and the storehouse for machine pieces. The loss is estimated at about $100,000.

From Paris to Rouen and Return.—Hydro-aeroplanes will ply upon the Seine from Paris to Rouen and back, according to the events which are now being organized in aeronautic circles in the city, and prizes to the amount of $4,000 are to be offered on this occasion. It was expected to hold the contest about the middle of October, but it will be postponed for a greater or less time on account of administrative difficulties as to interference with navigation and the like which it will take some time to settle. The event is to be an international one and is likely to bring out some brilliant performances, as Deperdussin, Borel, Rep and Nieuport hydro-aeroplanes are already engaged.

Experiments in Automatic Control by Gyroscopic Means.—Some interesting experiments have been made in automatically stabilizing an aeroplane in both the transverse and fore and aft direction by means of gyroscopes. Numerous test flights with a Curtiss biplane were made over water in a hilly country under exceedingly puffy wind conditions. The automatic control device, which is regulated by means of a small gyroscope, it is said, held the machine on an even keel under the most adverse conditions. This device, which is the invention of a well-known electrical engineer, is intended to produce the proper degree of banking at all times when the aeroplane describes a curve, and if its speed falls below 36 miles an hour, it is designed to cause the machine automatically to volplane. Two small gyroscopes, one for the transverse and one for the longitudinal stability, are employed, and the extremely small amount of power to run them is obtained from a dynamo which can also be used to send wireless messages. The whole apparatus, including the dynamo, does not weigh more than about thirty pounds. We expect to publish a complete description of this device in the near future.

Results Obtained by the Bulgarian Aeroplane Corps in the War with Turkey.—Word has just been received from a well-known war correspondent giving the results obtained by the Bulgarian and professional aviators who took part in the war which is now about at an end. Thirty aeroplanes of different types were used, and both the officer aviators and the professional airmen made many flights accompanied by military observers. These flights were never made at a lower altitude than 1,000 feet and usually at between 1,200 and 1,500, which this correspondent claims is out of reach of rifle fire. We learn from another source, however, that an aeroplane was hit by bullets when at a height of 4,000 feet, but the bullets did not in any case do serious damage. We have already reported the death of the Russian Poppoff, which it is now claimed was due to the machine having caught fire in the air. The aviator and his companion were killed by the fall sustained as the result of this accident. It is extremely doubtful whether Turkish bombs set the aeroplane on fire as originally claimed. A Bulgarian aviator was also killed and another captured. The city of Adrianople was set on fire by bombs dropped from Bulgarian aeroplanes, but the latter were unable to hit batteries or small bodies of troops without flying too low for safety. As for reconnoitering, the results were not as sensational as in some of the European maneuvers, though nevertheless very important. A trained military observer found it easy, after a number of flights, to locate battery positions, infantry trenches, or any considerable number of soldiers when in the open country, but not when they were under cover of trees or in the streets of a town. When the information was not obtained on a first flight, a repetition of this flight generally brought it. No aeroplanes were used by the army which fought its way to Tchatalja.

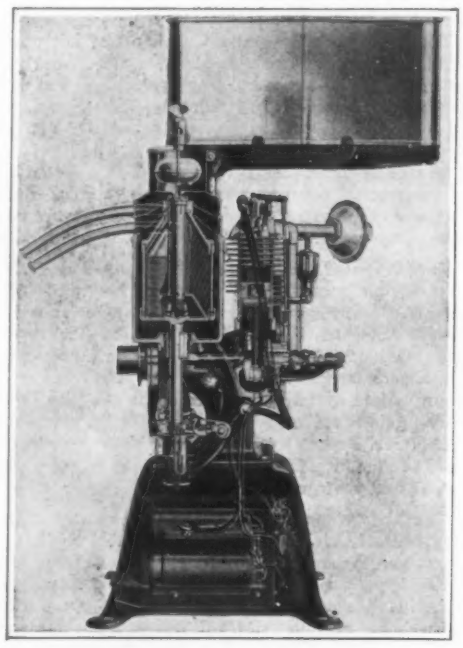
An Automatic Gasoline Engine Cream Separator

By Frank C. Perkins

THE accompanying illustration shows a novel gasoline motor-driven automatic cream separator, which is a most efficient farm labor-saving device. This machine is a combination gasoline engine and cream separator built into one, the power being supplied by a four-cycle ½ horse-power gasoline engine, which in 15 seconds has the bowl running at full speed.

No cranking of the engine is necessary, as a short piece of rope is attached to the starting pulley and pulled over as in spinning a top.

This separator has a capacity of over 700 pounds per hour and will skim faster than ten men can milk, and when the milking is done the skimming is done. The engine is also equipped with a flat pulley to be used in operating a washing machine, churn or any other hand power machine to which a gasoline engine is applicable. The belt can be disconnected from the separator bowl in an instant and the result is an independent gasoline engine of ½ horse-power.



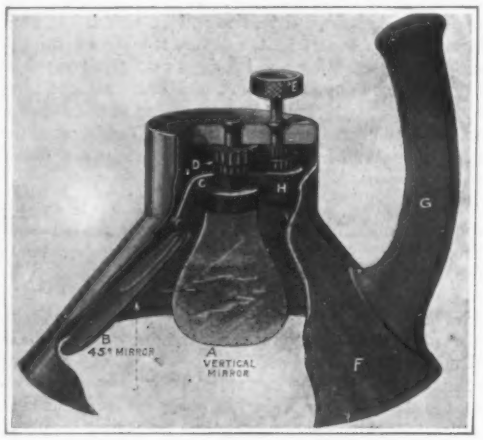
Automatic gasoline engine cream separator.

An Apparatus for Making Observations From Aeroplanes

By the Paris Correspondent of the Scientific American

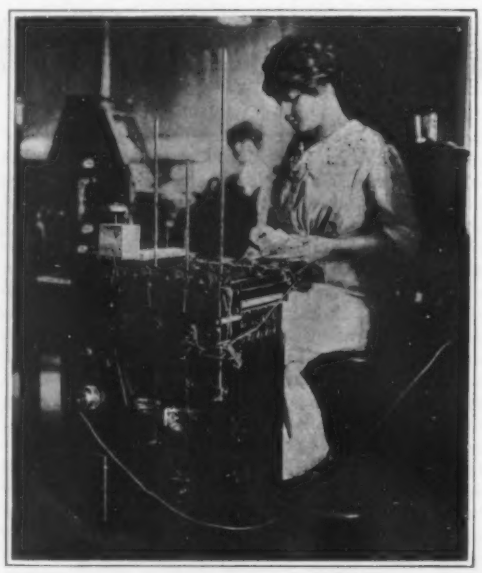
A FRENCH engineer, M. Duchene, has invented an apparatus for making observations from aeroplanes which is likely to prove very useful, especially for military work. The following description of the apparatus was presented at a recent meeting of the Académie des Sciences at Paris. When engaged in scouting or other work, it may at certain times be necessary for the observer to examine the ground over which he is flying and compare it with a map, and this may have to be done for a considerable time during the flight. Again, he may need to identify the ground after having lost sight of it owing to a fog, or at other times to note the exact position of a point on the ground, a camp or body of troops for instance, with reference to some prominent landmark. But the main difficulty which aviators find in observations of this kind lies in the speed of the flight, and as this is likely to become much higher as time goes on, the drawbacks will also increase. Theoretically, the aeroplane should stop on its flight so as to be able to obtain a perfect observation. One way to secure this is by making the aeroplane take circular flights around the ground to be observed, but this also presents the difficulty that the ground appears to the eye to turn about in the opposite sense to the flight. This effect is known to pilots to be very bad, and aeronauts who mount in spherical balloons see the difficulty that is found in observing the ground and comparing it with a map when the basket is making even a slight rotation. M. Duchene's apparatus is designed to keep the image of the ground in a fixed position with reference to the observer's eye, by using a set of two mirrors which are rotated oppositely to the aeroplane flight. In this way the ground always shows the same aspect to the eye, and the observer can compare it with a map without any trouble from the motion, as before. The apparatus consists essentially of a pair of plane mirrors *A* and *B* contained within a conical protecting cover *F* provided with a handle *G*. The whole is properly fixed to the aeroplane so that the image of the ground is received in the mirror *B*. This mirror is always inclined at a fixed angle of 45 degrees, and is held on an arm so that it can rotate about the central part and follow around in the inside of the conical cover. After once adjusting, the mirror is solid with the arm and has no other movement than that of a rotation about the central axis, so that it is always inclined at the 45 degree angle. Mounted at the center is a smaller and vertical mirror *A*, which can rotate about the central pivot, but always keeps the vertical position. It is evident that the image of the ground when received by the mirror *B* will be thence reflected horizontally into the mirror *A* and this reflects it horizontally into the observer's eye. Should an object (or the ground) underneath *B* be made to change in position, such object will no longer be reflected from *A* into the observer's eye, but he would need to change his position so as to continue to see the same object. What is now done is to keep the eye fixed, as is necessary in an aeroplane, and to rotate the mirror set by hand, so that the pilot keeps the same image always in his line of sight while the ground is moving with reference to the aeroplane. This is readily carried out by connecting the two mirrors by gearing in a way so that when *B* is made to rotate around its path, *A* also rotates at just the proper angle to keep the image always in the same line, that is, in the observer's eye. The movement of *A* thus continually compensates for the movement of *B*. Stated more accurately, if the mirror *B* is constantly operated by the hand so as to keep a fixed position in space (or with reference to the ground) while the aeroplane is in movement, the image reflected from *B* takes the corresponding rotation which is equal to that of the aeroplane. To compensate for this, and to keep the image always in the same line, the mirror *A* must rotate at an angle equal to half the angle through which *B* turns in one sense and the aeroplane in the other. This is the principle of the sextant.

All that is needed is to use a 2 to 1 gear ratio for the mirrors so that they rotate at the proper relative speed to meet these conditions, the large mirror turning at twice the rate of the small one, and the image of the ground is always sent into the observer's eye. He must operate the milled nut at the top so as to keep up the rotation of the mirrors and retain the image in his eye so that it appears fixed. This is readily done after a little practice. As the mirror *B* comes into a certain position around its path, it reflects the image from the other surface of *A* instead of the first, so that *A* must be silvered on both sides. This "dead point," however, can be passed over rapidly by properly operating the milled head. The inventor considers that the present design need not be a definite one, but is likely to be improved. It is sufficient, however, to show the principle of the apparatus.



Duchene apparatus for making observations from aeroplanes.

A, small mirror silvered both sides; *B*, large mirror; *C*, arm supporting large mirror; *D*, gearing which by action of winding mechanism, turns large mirror twice as fast as the small one; *E*, turning mechanism; *F*, protecting cover; *G*, handle; *H*, counterweight for large mirror.



A machine for counting bills.

A Mechanical Bill Counter for the United States Treasury

By C. H. Claudy

MONEY counting is an art. Any one can count a small sum of money slowly. To count a large sum of money quickly requires not only muscular skill of a high order, but strict attention. It is wearisome, nerve-racking. The monotony of it makes the human counter liable to error.

So a mechanical automatic money counter is a machine greatly needed, not only in the Treasury of the United States and its sub-treasuries, but in banks, counting houses and other establishments where large sums of money must be totaled constantly.

Not until Mr. John P. Buckley invented his money counting machine, however, did the Treasury officials believe that mechanism could take the place of the human brain. But the single machine of its kind in the world now counting laundered money in the basement of the Treasury at Washington, is the first of a larger order, and it is expected, if the twelve machines now being made for the Treasury prove the possibilities indicated by the present machine, to equip the Treasury with large numbers of them, as well as the sub-treasuries.

Mr. John P. Buckley is a special employee of the Treasury Department, whose work it is to devise, make and install special labor saving devices. Certain plans were submitted for a money counting machine. Mr. Buckley was invited to make it. He looked at the plans and said, "All right—but I can make a better one."

"Make both, and we will see," was the order given him.

So Mr. Buckley built the machine from the plans, and then designed and built his own, and when they were tried, side by side, the Treasury officials threw up their hands.

"Take the other thing away," they said. "Your machine is what we have been looking for!"

It may seem to the inventively inclined that a bill counting machine is not particularly difficult to make. Any rotary mechanism into which bills are fed could be attached to a mechanical counter and would count perfectly so long as bills are put into it. The trouble with all such mechanism is that a revolution of the machine would count a bill whether a bill were present or not. What is needed is a mechanism which won't count without the presence of a "green-back" in the mechanism. Attempts to make such mechanisms which depended on the slight weight of the bill have been made before, but are too delicate for constant use.

Mr. Buckley's machine utilizes an entirely different principle, which is absolutely certain in its action. It cannot count without a bill in the machine.

The attendant sits before a low table on which is a small and compact mechanism. In front of her are several small rapidly revolving rolls of a metal on top of which are rapidly revolving wheels of brass. These wheels and rolls are in contact, and through them runs a small (half ampere) electric current. When a bill is fed in between the brass wheels and the rolls, the circuit is broken. The current has been actuating an electric magnet. The instant the magnet ceases to act, springs raise two flap doors to the compartment toward which the rolls and wheels are feeding the money. The bill slips out of the rolls and rests on these little flap doors. The act of raising these doors by the springs has actuated a mechanical counter. The instant the bill is ejected by the rolls, the electrical contact is re-made, the magnets pull down the doors and the bill drops flat into the rack below.

When ninety-nine bills have fallen into the rack below, the little doors fly up as before for the hundredth bill, and count it, as before, as it passes through the rolls. But the little doors do not drop down again, a mechanical trip holding them in place. This is the signal for the operator to put a piece of blotting paper or other separator on top of the hundredth bill. She then presses a button and the doors drop, carrying the hundredth bill and its separator into the magazine below.

There are, in the present machine, three magazines, three sets of flap doors to them, three sets of rolls and three counters. There is also a general counter, which shows from one to one hundred on a dial, and

(Concluded on page 513.)

An American Small-arms Plant in Australia

A Triumph for American Machine Tools

A NOTABLE small arms manufacturing plant has recently been installed in Australia by the Government to manufacture military rifles. The contract was made under the auspices of the British Government, the rifle to be produced being identical with that with which the British army is now equipped, known as the Lee-Enfield.

This gun is one of the many adaptations of the original Lee gun—an American invention—the first one being made years ago in the works of the Pratt & Whitney Company at Hartford, Conn. The well-known Mauser is a Lee pattern, and the same principle is used in the guns of all the European armies. In the United States we call it the Springfield.

Bids were called for in London to furnish a plant to make Lee-Enfield guns at the rate of 50 per day. When Pratt & Whitney, the American company, applied for permission to bid, it was thought by the management of the Royal Arsenal that it would be impossible to make this plant outside of England, as it would be out of the question to have access to the British gages, and the Australian gun had to absolutely interchange in all its parts with the British weapon. The American experts, however, stated that if the British gun was made on the interchangeable plan, and their firm would be furnished with a gun, it would agree to produce one that would interchange with the other, creating its own gages from the gun itself.

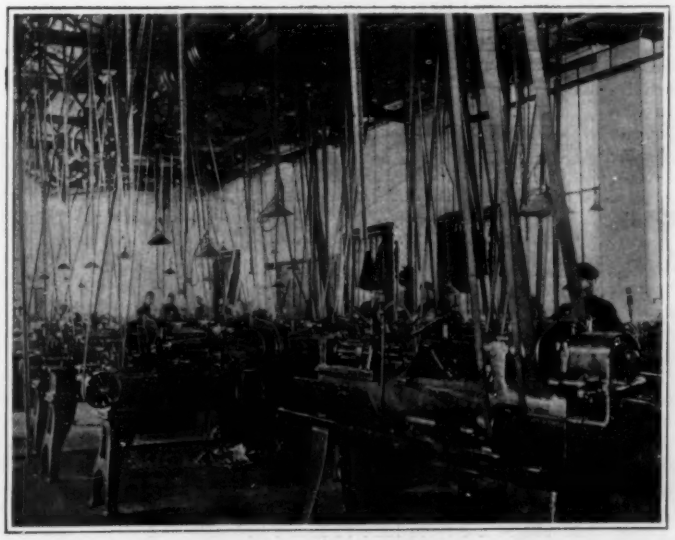
The arsenal authorities were very skeptical as to this, and remained unconvinced until it was actually accomplished.

When the bids were received it was found that the American proffer was almost identical in amount with that of the most favored English firm. The latter, however, included in its tender some seven hundred machines to produce 50 guns in a working day of ten hours, as against less than three hundred included in the American bid. This, naturally, caused considerable discussion, as the American price was the same for less than half the number of machines, showing the price per machine to be much higher.

The two firms were then asked to state how many working hours would be required per gun. The Americans gave a guarantee that its plant would produce this particular gun at the rate of 23 hours per gun, while the English firm gave just double this time, and intimated that the American firm could not possibly make good its time; and called attention to the fact that in the Royal British Arsenal something like 72 hours was required per gun. A most interesting situation was thus created.

Finally the Australian gun expert, Commander Clarkson, was dispatched to America to investigate the subject, which he did in a most able and thorough manner, the result being that he reported the art of gun-making, as developed by the American bidder, to be many years in advance of anything that he had been able to find elsewhere; and recommended in the strongest terms that the award be given to the American firm, and this was at last done.

General lathe workroom for making small-arms.



Turret lathe workroom.

It was understood that the British gun was being billed to the colonies at cost, which was figured at something over $21, while the American guarantee as to working hours per gun meant a cost of about one third of this amount; in other words, on an order for 100,000 guns it means a difference in the cost of, say, $800,000 against $2,100,000.

The arsenal plant set up in Australia is now completed and fully in operation; is accepted under the guarantee and paid for.

The machinery was tested before shipment for the manufacture of 100 guns, and it was shown that the 23-hour guarantee could be materially lessened. Some of the sample guns made at Hartford were submitted to the British War Office, where they were thoroughly and critically tested, and a report rendered that was most satisfactory.

Thus an equipment of about 300 American machines was shown capable of producing double the amount of work that 700 British machines could produce, and there seems to be no other explanation of the facts.

We frequently hear of the superiority of American machine tools, but it is seldom that such a clean-cut case of comparison can be had; hence this transaction is highly interesting.

Australian Antarctic Expedition

THE ship of this expedition, the "Aurora," after landing two parties in Wilkes Land early in the year (1912) returned to Sydney. The following (southern) winter was spent in oceanographic research south of Australia. Efforts were made to locate the reported Royal Company Islands, and the fact was ascertained that they do not exist at the position shown on the charts, though, owing to bad weather, it was not possible to be sure that no land exists in the vicinity. In fact, severe storms beset the ship through the winter and seriously hampered her work. A visit was paid to Macquarie Island, midway between Australia and the Antarctic continent. The five men left here the previous summer by the expedition were found in good health and doing good scientific work. Their wireless station was working splendidly, with a radius of about 2,000 miles. Up to the time the "Aurora" left Macquarie this station had not been able to pick up any communication from the station which Dr. Mawson had planned to erect on Adelie Land, in Antarctica, but it is reported that communication has since been established. The ship returned to Lyttleton, New Zealand, July 11th. After refitting, she was to start south from Hobart, Tasmania, in the (southern) spring, for the south base of the expedition.

The Parcels Post Zone System

The New Maps and How They are Used

By Emma M. V. Triepel, B.S.

THE work of preparation for the establishment of the parcels post is now complete, and the system in the United States and between the United States and Alaska, the Philippines, the Hawaiian Islands and Porto Rico will go into operation January 1st, 1913.

The law authorizing this service, which was passed August 24th last, provided that for the purposes of the parcels post administration, this country and its several possessions, except the Philippine Islands, should be divided into quadrangular units of area measuring 30 minutes latitude by 30 minutes longitude, identical with a quarter of the area formed by the intersecting parallels and meridians, represented on appropriate postal maps or plans, and that each of such units of area should be the basis of eight postal zones.

The completed maps show the numbered quadrangles, with the eight zones which radiate off from the center of a given unit indicated by circles drawn at intervals corresponding to a radial distance of 50 miles for the first zone, which includes the given unit and all contiguous quadrangles, 150 miles for the second zone, 300 miles for the third, 600 miles for the fourth, 1,000 miles for the fifth, 1,400 miles for the sixth, and 1,800 miles for the seventh. The eighth zone includes all units of area outside the seventh. The numbers and boundaries of the quadrangles are printed black, while the zone circles and figures are red.

The law directs that quadrangles lying partly in two zones belong to the one nearer the common center; so that the zone lines on the map, if drawn in strict conformity with the actual working out of the system in practice, would not be true circles, but would present a serrated appearance, corresponding to the projecting outlines of the intersected units.

Each postmaster has been furnished a map showing the zones with relation to the quadrangle which includes his post office, and a Parcels Post Guide containing regulations and the names of all post offices, with their unit numbers. No scale or other device for measuring distances or calculating rates will be used, as the zone map and guide provide all requisite information. Copies of the map accompanying this article will be furnished to the Washington, D. C., post office and all others included in quadrangle 1,071. Later, copies of the maps with reference to any given unit and the Parcels Post Guides will be sold for about the cost of production, to the general public.

As an example of the method of procedure in mailing packages through this system, suppose a five-pound parcel is to be sent from Washington, D. C., to New York city. Consulting the Parcels Post Guide, we find that New York's unit of area or quadrangle is number 767. Referring to the map, that number is found in zone three. A glance at the table of rates, at the left lower corner of the map, shows that 27 cents will be the amount due.

Suppose a package weighing 4 pounds 3 ounces is to be sent to Benson, Arizona. Referring to the reproduced page of the Parcels Post Guide, we find that Benson is located in quadrangle 4,385. Consulting the map, unit 4,385 is found in zone eight, with relation to Washington. The three ounces must be considered as a whole pound. The table shows that the rate for 5 pounds to zone eight is 60 cents. Suppose a 9¼-pound parcel is to be forwarded from Washington to Chicago, whose unit of area is number 2,115. The map shows this quadrangle lying partly in zone four and partly in zone five, so that it must be considered as lying wholly in zone four. The ¼ pound must be considered as a whole pound. Consulting the table, it is found that the cost of sending 10 pounds to zone four is 62 cents.

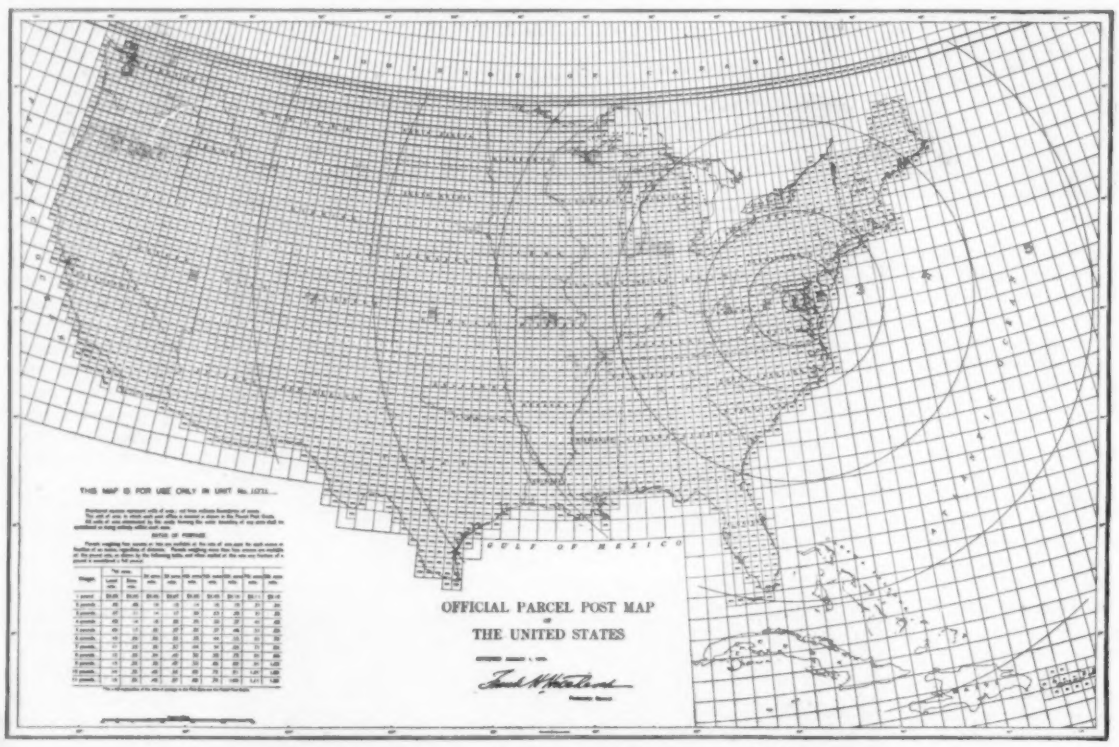
As a local example, suppose the Washington post office receives a 5-pound parcel addressed to 1840 R Street. Consulting the table given with the map, the local rate for 5 pounds is found to be 9 cents. These rates apply to rural delivery from the office where the route originates or from a patron on a route to the office where the route originates.

As an example of the application of suburban rates, suppose an 8-pound and 1-ounce package is to be sent from Washington to Annapolis, Md. The Guide shows Annapolis' unit of area to be number 1,021. The zone map shows that unit 1,021 is in zone one. The table indicates that the rate for 9 pounds in zone one is 29 cents.

Articles, to be mailable, must be not over 11 pounds in weight nor more than 72 inches in length and girth combined, nor likely to injure the mails or postal equipment or employees. There will be a flat postage rate of 1 cent per ounce up to 4 ounces, regardless of distance. Above 4 ounces, rates are by the pound and vary with the distance as shown by the table printed with the map.

The law provides that postage on all parcels shall be prepaid by affixing distinctive parcels post stamps. Hence, parcels bearing ordinary postage stamps will be treated as "Held for Postage." A dozen denominations of these special stamps, ranging in value from a cent to a dollar, have been prepared and are now being supplied to the postmasters. Parcels will be mailable only at post offices, branch post offices, lettered and local named stations, and such numbered stations as may be designated by the postmaster. Parcels will not be accepted for mailing unless they bear the return card of the sender. The problems of warehouse and terminal facilities, automobiles and other vehicles in which to convey parcel mail, street boxes suitable for the deposit of such mail and the utilization of present carrier force are among the questions involved which have been carefully considered by the Parcels Post Committee. One of its first acts was the issuance of bids for the purchase of 70,000 weighing scales for the post offices. Since many of the objects to be carried will be of a fragile nature, the question of indemnification for lost and damaged articles will be an important one.

The postal express business thus organized will not only cover all of the systems of transportation now utilized by private express companies, but will be extended to more than a million miles of rural delivery and star route service.



The official parcel post map which will be used by the city of Washington.

THIS MAP IS FOR USE ONLY IN UNIT No. 1071

Numbered squares represent units of area, red lines indicate boundaries of zones.
The unit of area in which each post office is located is shown in the Parcel Post Guide.
All units of area intersected by the circle forming the outer boundary of any zone shall be considered as being entirely within such zone.

RATES OF POSTAGE

Parcels weighing four ounces or less are mailable at the rate of one cent for each ounce or fraction of an ounce, regardless of distance. Parcels weighing more than four ounces are mailable at the pound rate, as shown by the following table, and when mailed at the rate any fraction of a pound is considered a full pound.

Weight.	*1st zone. Local rate.	*1st zone. Zone rate.	2d zone rate.	3d zone rate.	4th zone rate.	5th zone rate.	6th zone rate.	7th zone rate.	8th zone rate.
1 pound	$0.05	$0.05	$0.06	$0.07	$0.08	$0.09	$0.10	$0.11	$0.12
2 pounds	.06	.08	.10	.12	.14	.16	.19	.21	.24
3 pounds	.07	.11	.14	.17	.20	.23	.28	.31	.36
4 pounds	.08	.14	.18	.22	.26	.30	.37	.41	.48
5 pounds	.09	.17	.22	.27	.32	.37	.46	.51	.60
6 pounds	.10	.20	.26	.32	.38	.44	.55	.61	.72
7 pounds	.11	.23	.30	.37	.44	.51	.64	.71	.84
8 pounds	.12	.26	.34	.42	.50	.58	.73	.81	.96
9 pounds	.13	.29	.38	.47	.56	.65	.82	.91	1.08
10 pounds	.14	.32	.42	.52	.62	.72	.91	1.01	1.20
11 pounds	.15	.35	.46	.57	.68	.79	1.00	1.11	1.32

*For a full explanation of the rates of postage in the First Zone see the Parcel Post Guide.

Explanation of the map and the method of charging.

To Our Subscribers

WE are at the close of another year—the sixty-eighth of the SCIENTIFIC AMERICAN's life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

Electrical Ship Propulsion

MARINE engineering experience shows that the motive power for driving the propellers of seagoing vessels should be easily and quickly reversible, capable of being speeded up and down quickly, and able to run economically at almost any speed for long periods in smooth or rough water with less than eight per cent deviation. The machinery should all be easily accessible, economical in fuel, and have the simplest and fewest working parts. The fact that electrically driven vessels are the only ones complying with these requirements was pointed out in a recent paper read before an English engineering society. Attention was also called to the fact that with the electric drive the steam and power generating plants may be placed well forward, while the driving motors may be installed as far aft as the lines of the ship will allow.

Removal of the Beach Hydraulic Tunneling Shield

AFTER having been embedded in sand under Broadway at the south end of the tunnel opposite the south side of Murray Street, some eighteen or twenty feet below the surface of the street, for more than forty-three years, the Beach shield, regarded as the pioneer in its line, was cut apart and removed from its resting place on December 2d by the Degnon Contracting Company, the builders of section two of the new four-track subway under lower Broadway, between Walker Street and Mail Street. During this period the wood portion of the shield, which was located between the front and rear iron rings, had completely disappeared, but the iron parts were as complete as when originally installed. The eighteen hydraulic propelling rams were in good condition, the screw threads at their inlet ends, where the inlet pipe is attached, were perfectly fresh and good as if they had just been made. The iron inlet pipe was secured to the ram by a very heavy thick brass nut. The quarter inch thick iron hood, over two feet wide by about twenty-seven feet long, except for a small film of rust on its surface, was in serviceable condition. It overlapped the cast iron rear hydraulic ram ring and was secured to the woodwork just ahead of the ring with 4½ inch long iron bolts, having flat heads on the outside. The bolts were attached to the hood on its removal, a few having been reduced in diameter by rust.

The interesting feature is that this machine was made and operated by manual power day and night under Broadway with its heavy omnibus traffic going on overhead without in the least disturbing the same, removing only the actual amount of earth the tunnel was to occupy, and this before the age of steel and electricity as we know it to-day.

When the tunnel was being bored and the shield was near the north side of Murray Street a heavy stone wall was encountered; by careful management the stones were removed in front of the shield, leaving an arch in the wall near its top. When the opening through the wall was large enough the shield was pushed through it into the sand beyond. No one seemed to know why the wall was there; it was conjectured that it might have been the remains of an old Dutch fort. Since the excavation for the subway, some forty feet below the street surface, the supposed fort turns out to have been a large cistern of some kind and is probably one of many that used to be located in the center of the streets to supply water before water pipes were introduced. The parts of the Beach shield have been sent to Ithaca, New York, and presented to the College of Civil Engineering of Cornell University, of which Mr. E. E. Haskell is Dean, by Mr. Frederick C. Beach, son of the inventor, Mr. Alfred E. Beach (now deceased), where it is to be set up and restored for permanent exhibition. Mr. Alfred E. Beach was granted a patent on this shield in 1869. Particulars relating to its construction may be found in the SCIENTIFIC AMERICAN of March 5th, 1870, and its use in tunneling under rivers on a large scale is described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 764, of August 26th, 1890.

The Problem of Providing a Radium Container

WHEN making use of radium, some suitable containing vessel is needed, but glass or aluminium, which are commonly used, stop off some of the rays in each case, so that such rays are not allowed to act. This M. Lieber proposes to remedy by using a surface layer of radium compound applied as a coating on a suitable backing. To prepare the coating he dissolves the radium salt, in the case of coating upon celluloid, in ether, acetone or the like. The celluloid takes the shape of disks or rods and these can be dipped into the solution or the latter can be spread in a thin layer on the surface. After evaporation, the radium is distributed in a uniform layer in this way, and the solvent is chosen so that it adheres well to the surface. When it is desired to use the radium in direct contact with liquids such as blood or other liquids of the body, a collodion coating is given to the layer, and this allows the emanations and also the α-rays to pass, as is proved by experiments. The method allows of obtaining powerful effects with a small amount of radium, which could not have been secured before, and all the emanations of the radium are utilized. It should be noted that the treatment of lupus and cancer requires the β and γ rays which are produced exclusively by the emanations, and these latter are well obtained here in a continuous manner. Celluloid tubes coated on the inside can be used for treating mineral water by the rays so as to have these absorbed by the water. Such tubes can also be employed for inhaling air through them in treating lung diseases, as the air thus becomes charged with radium. By coating glass microscope slides, specimens can be put directly upon them so as to study the action of radium upon microbes.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Yards Per Second

To the Editor of the SCIENTIFIC AMERICAN:

In your September 28th, 1912, issue you have an interesting article entitled "Why Not Feet per Second?" As you state in this article, it is quite true that we use the term "miles per hour" even when calculating rates of speed for very short distances, and your suggestion that "feet per second" be generally used is a very good one.

In this connection, would it not be better to use the phrase "yards per second" rather than "feet per second," in view of the fact that "yards per second" is approximately one half "miles per hour," and likewise "miles per hour" is approximately two times "yards per second"? Do you not think the proportions one half and two times, above mentioned, preferable and more convenient in calculation than one and a half times and two thirds as mentioned in your article? READER.

Yokohama, Japan.

The Pilot Charts and the Weather Bureau

To the Editor of the SCIENTIFIC AMERICAN:

Your editorial in the current issue of the SCIENTIFIC AMERICAN regarding the renewed effort on the part of the Weather Bureau to take over certain of the work of the U. S. Hydrographic Office is quite apt and to the point. Without detracting in the least from what good work the Weather Bureau really does, it is pertinent to remember that its duties are but a development of an effort designed primarily to help the farmers of this country—hence its identification with the Agricultural Department. Its expansion along with other lines for the general public ashore is a logical evolution which will cover a sufficient field if it halt there.

The Pilot Charts issued by the U. S. Hydrographic Office are the combined fruit of the professional experience of our naval men and the civilian seafarers of all nations, and this product of co-operation is the consequence of that fraternal feeling which is a part of the mutual respect born of hazards shared in common. The sailorman, therefore, feels strongly when the documents and guides for his safety upon the sea are menaced through the editorship of landsmen, who are out of touch with the sea and with whom the merchant skipper can feel no inspiration to co-operate. It is this very sentiment of fellowship and understanding which now brings to the U. S. Hydrographic Office so much material of interest and value. ROBERT G. SKERRETT.

New York city.

The Mississippi Problem

To the Editor of the SCIENTIFIC AMERICAN:

For a few weeks I have been a resident in the upper edge of the great coastal plain, and have been studying the river problem, so apparent in the great bend just below us, and none the less between us and the Gulf. The last hill overlooking the Mississippi River on the west is at Commerce, Mo. Not far below, across the lowlands, is the St. Francis River, which seems to lose itself in the sunken lands of Missouri and Arkansas. To cut a canal to this stream, which could easily be widened and straightened, would not be a great task. Just above the mouths of the White and Arkansas, and across the same to another stream flowing into Red River, the cutting would be surprisingly small. Already the surplus water of the Mississippi is finding a way up the Red to the opening of the Atchfalaya and saving a hundred miles to the sea.

An examination of the route I have indicated shows an easy way to solve the river problem. This has been suggested by others, but is receiving less consideration than it deserves. The fall of the water would be about 300 feet. Locks might be a necessity in low water. A fine ship canal cutting off at least 300 miles, as measured by the river, would be a boon when the Panama canal is in operation. The flood of the Mississippi could be drawn off sufficiently to prevent the disaster incident to the usual high waters along the lower reaches of the river. The river would raise its bed from deposits less rapidly, and the necessities of the repair boats would be reduced. The river is being navigated without the 14-foot channel, and this would not be interfered with in the least. It would give two water routes instead of one. The energies of the Government, so soon to cease on the Isthmus, can be employed to no better advantage than in solving our river problem. It is hoped the citizens of the central valley will not allow this movement to be forgotten.

Olive Branch, Ill. C. W. CAMPBELL.

The Bath Tub Decision

To the Editor of the SCIENTIFIC AMERICAN:

Your attention is directed to the second paragraph of the editorial entitled, "The Bath Tub Decision and the Patent Law," appearing in the SCIENTIFIC AMERICAN of November 30th, 1912, and especially to the statement therein that "*Had that price been determined by the owner of the patents*, as in the rotary mimeograph case, and had there been no combination of licensees, the decision of the Supreme Court would have been different."

The decision in the Bath Tub case rests on the fact that there was a combination of licensees in restraint of trade within the prohibition of the Sherman law. Clearly, if the combination to restrain trade in an unreasonable manner could not be shown, the grounds for prosecution under this law must disappear.

The fixing of prices is an element of the restraint exercised by this combination; but in the absence of this element another might well be the foundation of such restraint, and I have read the decision in vain to find any foundation for the inference expressed by the SCIENTIFIC AMERICAN, that the fact of determination of prices by the combination, rather than by the owner of the patents, had any other bearing on the decision than to indicate restraint of trade by the combination.

The question as to whether a patentee may lawfully impose restrictions as to the price of an unpatented article, in the manufacture of which a patented article is used, is not decided by the Bath Tub case. Indeed, the Court expressly declares in its opinion that the decision is made "without entering into the consideration of the distinction of rights, for which the Government contends, between a patented article and a patented tool used in the manufacture of an unpatented article."

Accordingly, it is thought that the statement noted is misleading in so far as it includes, as a *ground for the decision*, the question of whether prices are determined by the combination or by the owner of the patents.

Washington, D. C. E. H. MERCHANT.

[It is true that in its decision the Supreme Court used this language: "The added element of the patent in the case at bar cannot confer immunity; and this we say without entering into the consideration of the distinction of rights for which the Government contends between a patented article and a patented tool used in the manufacture of an unpatented article." Our editorial was certainly not intended to convey the impression which our correspondent states was conveyed. The Bath Tub case clearly fell within the Sherman law. Our only point is that had there been no combination of licensees, had the owner of the patent granted licenses and fixed the prices without collusion, the decision would probably have been different.—EDITOR.]

The Prone Position for Aviators

To the Editor of the SCIENTIFIC AMERICAN:

Time and again it has been pointed out in the columns of this and other journals, that a stricter observance of streamline forms and sections in the design of an aeroplane would result in a marked increase in the craft's efficiency. In view of this, it might seem rather surprising at first sight that, though the principle has been very faithfully followed in the best machines as regards the design of wing profiles and certain other elements, so far no serious attempt has been made to construct a machine in which the aviator, engine, fuel tanks, etc., are totally inclosed in one streamline body.

The reason for this, however, is not an ignorance on the part of constructors of the advantages to be gained from such a form, but rather an acquaintance with the difficulties that underlie the construction of a machine such as would render the inclosing of the aviator practical. For they realize that the increase in cross-section required to inclose one aviator in a sitting posture, would necessitate a greater loading to obtain the highest efficiency; and with the addition of weight, fresh difficulties arise. Provision for variable surfacing would be absolutely essential in a large machine (for efficiency), and this latter has not been worked out as yet. Also, a more substantial running gear would necessarily need to be provided, and this again would involve an increase of head resistance.

But there is one way out of the difficulty which the writer has never seen proposed. Man's upright position is little calculated to cleave the air with least resistance. The position of the body which would offer the minimum of head resistance in flight is the prostrate one, and the writer suggests that the aviator lie along the car with his body curved sufficiently for comfort. It would be a simple matter to work out the details.

Now this idea may seem somewhat fanciful; but flights in such a machine would undoubtedly do more toward impressing upon constructors the remarkable efficiency of the form, than any amount of theorizing or even of laboratory experimenting. It may seem more dangerous than the sitting posture; but the impetus given to the design and construction of a practical weight-carrying machine would justify the danger, such as the performance of dips, and dives, and other equally foolhardy evolutions in midair (infinitely more dangerous) never has nor will. G. I.

Whitby, Ontario, Canada.

Catapulting a Hydro-aeroplane from a Fighting Ship

Adapting the Flying Machine to the Requirements of the Navy

By Robert G. Skerrett

BY the testing of an apparatus for the launching of aeroplanes from a ship, Capt. Washington I. Chambers, U.S.N., its inventor, clearly proved that the hydro-aeroplane may take its part as an essential feature of the equipment of all large men-of-war. It is doubtful if the general public realizes the prophetic significance of that performance at the Washington Navy Yard on the 12th of November. It marked a stage in the adaptation of the aeroplane for service with the fleet which began but two years ago, and was practical evidence of the surmounting of difficulties which were most discouraging in the early stages of the work. Appreciation of what Capt. Chambers has accomplished can be had by reference to the history of previous efforts described in these columns, of the scout cruiser "Birmingham" at Norfolk, where upon her forecastle deck was built a temporary wooden platform.

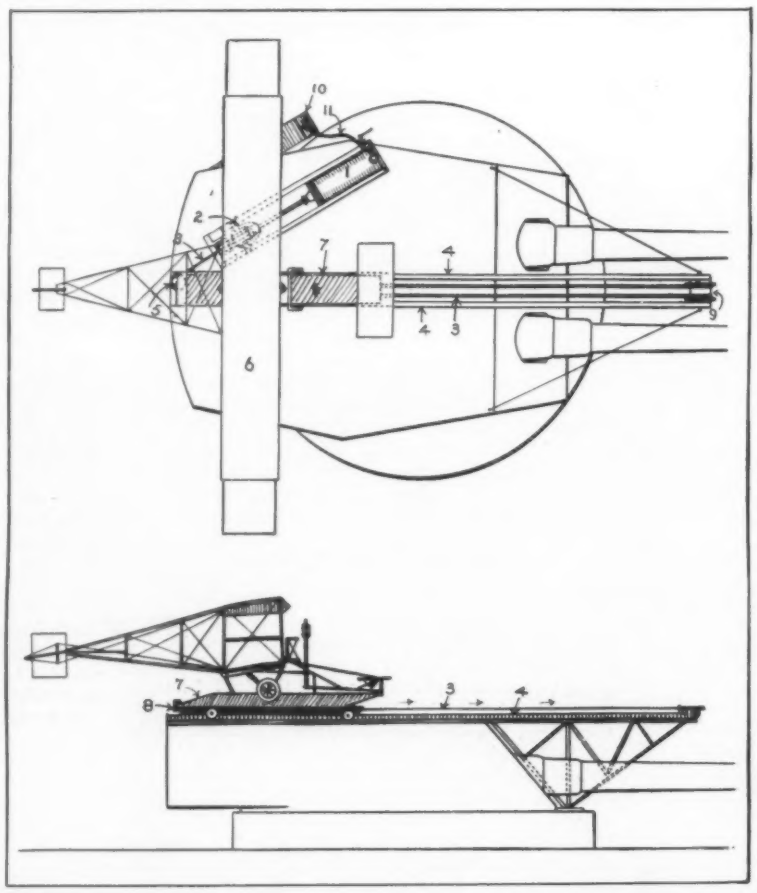
The next attempt was from the "Pennsylvania," and both served to prove that the aeroplane could not be a part of the fighting fleet if runways of so extensive and interfering a character had to be erected upon a vessel's deck.

The next development was Mr. Glenn H. Curtiss's hydro-aeroplane, and he continued to improve it till the boat could return to its base by alighting upon the sheltered water on the lee side of the ship and then be picked up and landed aboard successfully, but it had to be started on its scouting from the deck of the man-of-war.

Capt. Chambers has long been one of our torpedo experts, and his early experience in launching those weapons from above water gave him a helpful hint, and his catapult tried at Annapolis some months ago was his first essay in projecting an aeroplane into the air upon a short track, and giving it in that distance the necessary headway required by the high-speed flying machine. Compressed air was the motive power and the launching device was mounted rigidly upon the wharf. The aeroplane was set upon a car which traveled upon a track about 35 feet long, and both were free to lift from the rails during any part of the travel or after the aeroplane motor had started and had reached a sustaining speed. The full air pressure, of 290 pounds, was turned into the cylinder which operated the cable attached to the car. There was no gradual acceleration of the translation of the supporting vehicle—it started forward with a jump! Upon the occasion of its trial, with the aviator in his seat, the aeroplane lifted at about midstroke of the piston. A cross wind was blowing at the time, the right wing was forcibly lifted, and the flying machine tumbled with a corkscrew motion into the water; also the pilot, Lieut. Ellyson. The test in question was twofold in its purpose—to project the aeroplane into the air after a short run and to observe the effects upon the aviator and the various parts of the apparatus. It was feared that the shock might derange the motor and other parts of the mechanism and incapacitate the aeroplane so that it could not take up the work of its own propulsion. Quite naturally, Capt. Chambers and his associates were gratified to find out that no part of the machinery or the fittings was ruptured or weakened by that venturesome performance. The fact that the aeroplane and the aviator were given a ducking was of secondary importance.

The hydro-aeroplane at the instant of leaving the catapult, with Lieut. Theodore H. Ellyson at the wheel.

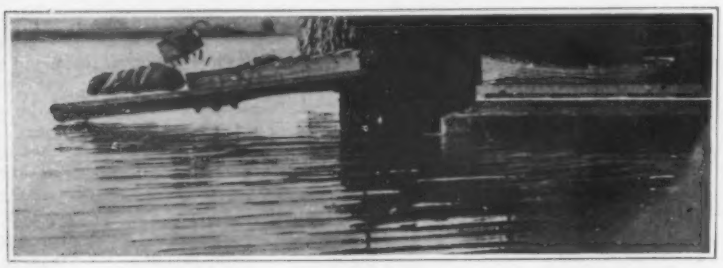
The launching car of the catapult is seen below the pontoon in the act of falling away toward the water.



Plans and side views of Capt. Chambers's catapult for launching aeroplanes from battleship turrets.

1. Catapult motor operated by compressed air from tank 10. (11 air connection.) 2. Pulleys that multiply the movement of the tractor cable. 3. Tractor cable connecting the catapult motor with car 8. 4. Rails on which car 8 runs. 5. Pulley for cable. 6. Flying machine. 7. Float of hydro-aeroplane. 8. Car. 9. Pulley.

Profiting by the lessons learned at the Annapolis trial, Capt. Chambers devised the catapult tested so successfully at Washington, and what this means in the way of advance can be gathered by comparing it with the platform that was necessary when Ely made his flights from the U. S. S. "Birmingham" and the U. S. S. "Pennsylvania." The present launching apparatus is so small that it occupies but little space; it can even be mounted for use on top of a turret; it can be quickly moved to any position on the ship; and it can be readily dismounted and stowed away clear of the sweep of the guns. As in the case of the Annapolis device, compressed air is the source of motive energy, and this is always available on ships carrying torpedoes or using compressed air for other purposes. The necessary air, at a suitable pressure, is stowed in a small cylinder on deck conveniently located for connection with the catapult. The piston of the cylinder has a stroke of something like 40 inches, and the piston-rod movement is multiplied by means of a wire-rope purchase, and this wire rope draws forward the small wooden car upon which the aeroplane rests. In order to launch the flying machine, both it and the car are projected from the rails at the end of the run, and this takes only 1½ seconds of time. The car simply drops out of the way, and if the rails reach to the side of a ship, the vehicle is recovered by means of a rope attached to it. The car gathers headway smoothly; there is none of the shock which characterized the operation of the pioneer apparatus at Annapolis, and this is accomplished by a clever arrangement which controls the increment of the air pressure automatically, and thus gradually accelerates the forward motion throughout the entire stroke of the piston. At Washington, the catapult was placed upon a float and the bottom of the hydro-aeroplane was not more than 2 feet above the water. This did not provide much of a margin for the machine to dip ere its motor took up the work of propulsion. However, when the test was made, the flying machine arose gradually and steadily upon a beautiful flight as soon as it left the rails, and there was not the slightest tendency to seek the water. It is true that the float was pointed toward the wind, but at the time of the trial the



A preliminary test of the catapult.

The car was loaded with heavy sandbags to represent the weight of the flying machine, and the box-like block uppermost in the air was held to the car by the same holding-down strap that serves to secure the hydro-aeroplane until the moment of its desired release. The relatively light car is seen falling away from the heavy sandbags and the block which played the part of the flying machine.

The catapult just before the machine was launched.

Before the flying machine is launched the catapult is placed upon a float and the bottom of the hydro-aeroplane is not more than two feet above the water. This does not provide much margin for the machine to dip ere its motor takes up the work of propulsion. The machine rises gradually and steadily upon its flight without any tendency to seek the water.

air was nearly calm. Just the same, the functioning was of such a character that the experts express confidence in the fitness of the catapult for service aboard ship. Certainly much credit is due Lieut. Ellyson for the nerve and courage he has shown in eagerly offering himself for these tests, and this fact gives additional value to the claims now made for the catapult. It is of interest to note that in the demonstration at Washington—contrary to that at Annapolis—the aeroplane was held down to the car by an iron strap, and this was released by a tripping device which engaged an arm of the strap at the far end of the rails. This made certain the aeroplane thus acquiring sufficient velocity to give it a lifting impulse at the end of the launching run.

Because of recent improvements in the hydro-aeroplane and the development of this catapult, Capt. Chambers confidently predicts the following uses of the flying machine in naval warfare, and these give us an impressive idea of the way the art has advanced in the last two years:

They can be carried, stowed, and used by all large ships for the purposes of:

1. Reconnoitering an enemy's port or to search out his advanced bases and to assist in the operations of a blockaded or of a blockading force.

2. To locate and destroy submarine mines, submarines, and dirigibles, and to assist in the operations of submarines and torpedo boats.

3. To damage an enemy's docks, magazines, ships in repair or under construction, dirigible sheds, and other resources.

4. To provide means of rapid confidential communication between a fleet commander and the commanding officer of a co-operating force on shore, or the commander of another fleet or division.

They can be carried by all scouts and cruisers.

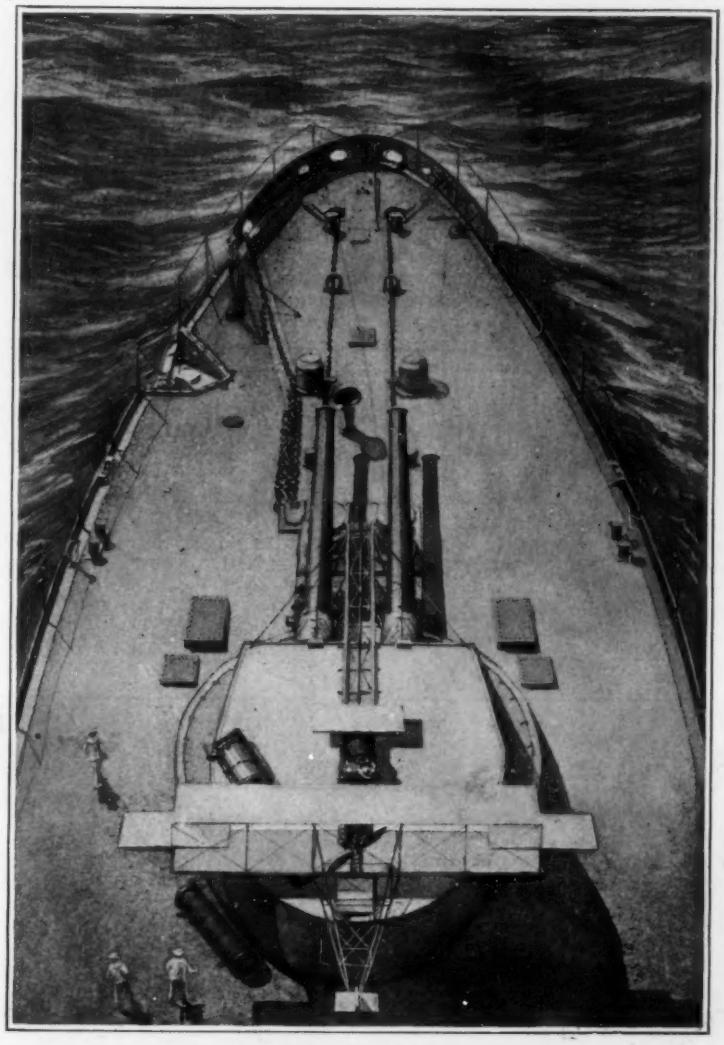
5. To extend the "eyes of the fleet" in naval scouting.

They can be carried, with ample supplies and camp outfit, on board any naval supply auxiliary.

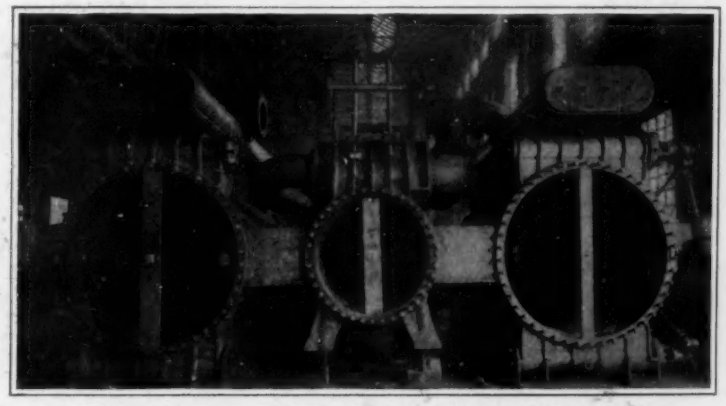
6. For scouting at advanced bases and for extensive use with expeditionary forces.

A Notable Great Lake Passenger Steamer

THE American river steamboat is a peculiarly American type, standing in the same relation to steamships in general as does the multi-masted American schooner to the sailing ship. Its strongly marked characteristics are due to the influence of local conditions of navigation and to certain national demands in the way of comfort and general accommodations. Whether it be found on the Mississippi or the Hudson, or in the sheltered waters of Long Island Sound, there are certain leading characteristics which make the type readily recognizable, and differentiate the American craft from any other of its kind in the world.



Capt. Chambers's catapult for aeroplanes.



High and low-pressure cylinders for the "City of Detroit III."

Diameter high-pressure, 62 inches; low-pressure, 92 inches; stroke, 102 inches; horse-power, 8,000.

To our thinking it is the most picturesque and impressive of all the stately vessels which carry the world's commerce; and although the largest of them are but half as long as such ocean liners as the "Olympic" and "Imperator," the effect of their imposing and many-storied tiers of staterooms, and the long, clean lines of hull and superstructure, is to deceive the eye into thinking them greater than they are—an effect which is heightened by the fact that they are generally seen against a background of small river craft or against the moving panorama of river bank or proximate shoreline.

To those of us who are familiar with the majestic boats that ply on the Hudson and Long Island Sound, it will be surprising to learn that the growth in size of the sidewheel passenger steamer on the Great Lakes has been so rapid that to-day the largest vessel of this type is to be found on those waters. We present illustrations of this steamer, the "City of Detroit III." which has been built for the service between Detroit and Buffalo. The principal dimensions are: Length over all, 470 feet; keel, 455 feet; breadth, 55 feet 4 inches molded; breadth over guards, 96 feet 6 inches; depth at stem, 22 feet; depth at stern, 29.25 feet. The hull is built of steel with double bottom. It is divided into eleven compartments by water-tight, cross bulkheads, extending from the keel to the main deck. The bottom is divided at the center line and athwart-ships into fifteen water-tight tanks. There are two decks below the main deck and three above. The main deck and housing on the main deck and orlop deck are also of steel. A steel superstructure is carried to the main deck. The ceiling of the saloon deck is sheathed with galvanized iron, practically making the entire housing up to the saloon deck fireproof. A steadying tank of 100 tons capacity is provided amidships to check rolling in heavy sea.

The ship is driven by paddle-wheels; and she is the longest paddle-wheel steamer afloat. The engine is of the inclined, three-cylinder, compound, jet-condensing type, having one high-pressure and two low-pressure cylinders. The estimated indicated horse-power is 8,000 at 30 revolutions per minute. The high-pressure cylinder, which is 62 inches in diameter, weighs 47,200 pounds. It is placed between the two 92-inch diameter low-pressure cylinders, all having a compound piston stroke of 102 inches. The high-pressure cylinder is fitted with poppet valves and Seckles cut-off gear; the low-pressure cylinders have Corliss valve and gear. All the valves are operated by ordinary double-bar Stevenson link motion,

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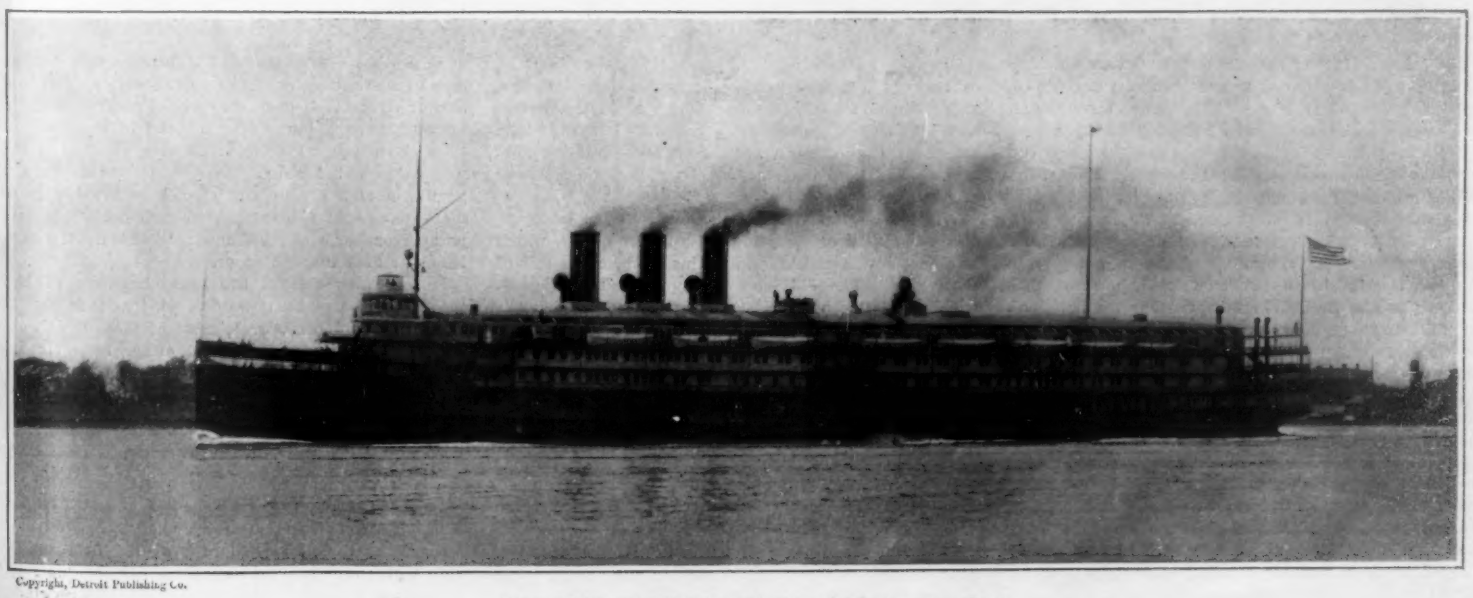


"City of Detroit III," largest side-wheel steamer afloat.

Length, 470 feet; breadth, 55 feet 4 inches; breadth over guards, 96 feet 6 inches; horse-power, 8,000; speed 21 miles an hour.

Working a Whistler

A Dangerous Task That Requires Skill

By C. H. Claudy

SEA-TRAVELERS up and down our coast lines often hear a strange, weird sound to port or starboard, a sort of compound of moan and shriek, at once soft and insistent, subdued and penetrating. It is the call of the whistling buoy to the man at the helm, warning him of shoal or dangerous place, giving him his bearings, by which he may steer his vessel in safe water.

These whistling buoys, which are enormous masses of iron, often weighing several tons, are as simple in principle as they are certain in operation. The buoy proper consists of a huge pear-shaped bulb, little end up, on top of which is a powerful whistle, protected from accidental blow or collision by a framwork of iron bars, and an air intake. Below and projecting far down into the water is an open tube of metal. The whole thing is secured in position with an anchor and a chain, which last is long enough for the depth of the water in which the buoy is placed, to permit the free movement of the mass up and down.

When a wave lifts the buoy up in the air, the water in the tube, acting as a piston, sucks in air through the intake. It is confined in the bulb of the buoy by a simple valve which prevents its egress through the intake. When the waves drop the buoy in the trough of the waves, the water in the tube presses up on the confined air and compresses it. It finds exit through the whistle, which thus sounds its warning note.

Whistling buoys are only placed in water where the wave action is fairly constant, so that calms and fair weather will not stop the action of the buoy any more than can be helped. It should be noted, however, that the buoy is less needed in fair weather than in foul, and that it takes comparatively little disturbance of the water to make the buoy sound its warning. The higher the waves, of course the louder the sound.

There are eighty-eight of these buoys at present in service in this country, and twenty-five whistling buoys which are also light buoys, showing a visible signal at night. They differ in size, from the small ones used in harbors and where the sound need not be very powerful in order to reach as far as may be necessary, to the huge masses of iron which are given to the water as a plaything at the entrance to harbors or wherever a shoal needs a warning signal which cannot, or for other reason should not, be cared for by a lighthouse.

It might be supposed that, having no mechanism but a valve, such buoys, once put in position, could be left there for an indefinite period of time. But the sea has strange ways with her playthings, and, even if the necessity of constant painting of the buoy to protect it from the action of sea water was not existent, it would still be necessary to keep a watch on these signals, and to take them up and replace them rather often. For the big tube projecting down into the water is a great attraction to barnacles and sea weed, and not infrequently these marine growths so interfere with the action of the buoy as to keep it silent in ordinary weather and to dim its voice in bad weather.

It then becomes necessary to "work" a new whistler in position, which is a regular part of the duty of a lighthouse tender or buoy tender, of which vessels there are many in the Lighthouse Service.

When a buoy is to be "worked," the tender repairs to a yard or station, and by means of her crane, lifts on deck the freshly painted and thoroughly repaired new buoy, which is to replace that one which is either silent or which has served its allotted time and is now due for replacement.

There is nothing difficult about this; it is getting the enormously large and unwieldy mass of iron overboard and taking on board the one which is in the water, which causes the difficulty. The very waves which are necessary to the successful operation of the buoy make it hard to manage at the end of a crane on board a comparatively small vessel.

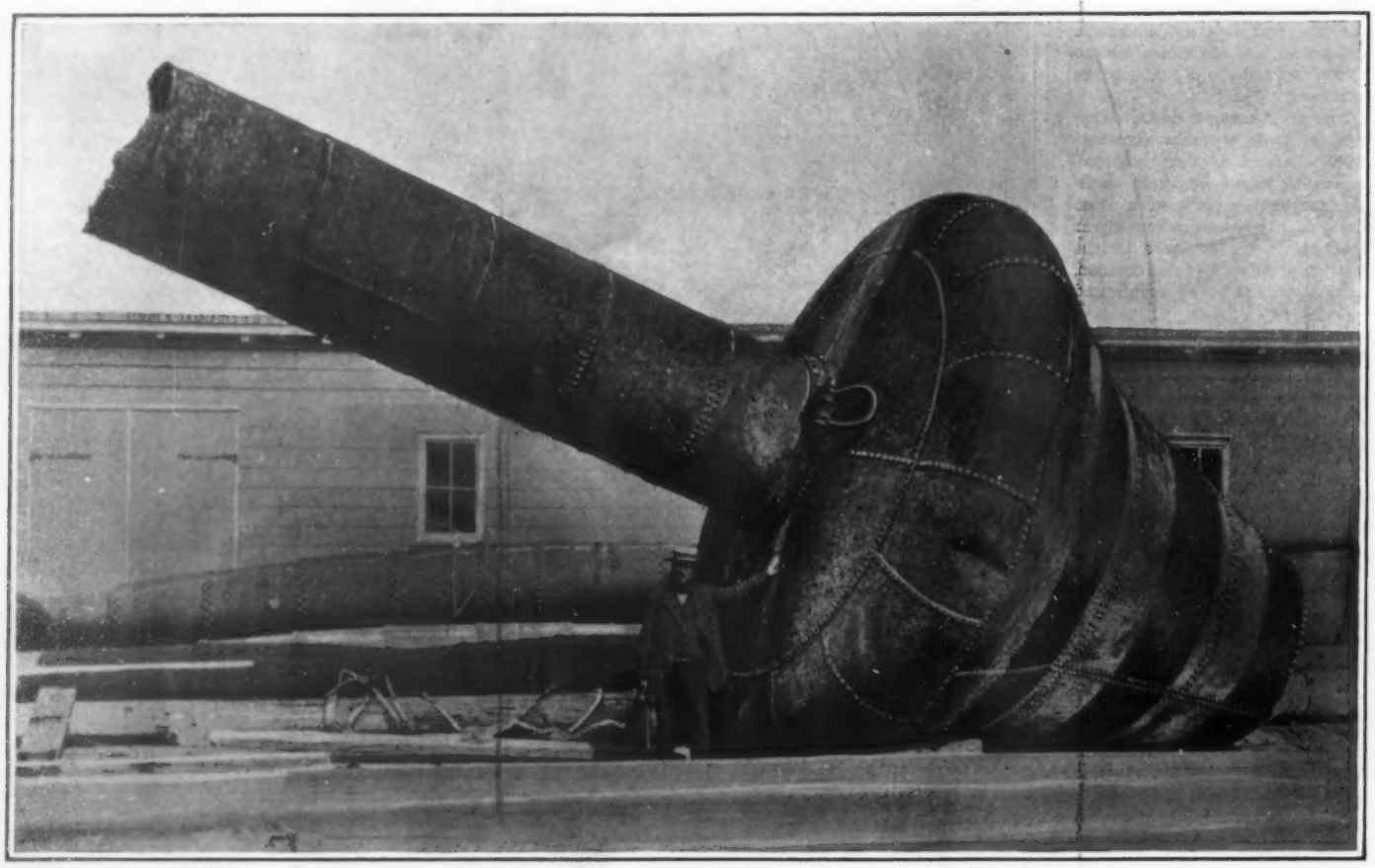
When a buoy tender goes to "work" a whistler she clears her deck of everything else but the buoy, which is secured with chocks and chains against the roll of the vessel. The old buoy is approached cautiously, within a couple of hundred feet, and the new buoy is allowed to slide overboard, rather than picked up and placed in the water, the crew guiding it by guy ropes while the powerful crane lifts just enough to permit the buoy to move. With the vessel slowly rolling from side to side on the slow seas of even a quiet day—the good days are purposely picked for this work—the mass of freshly painted iron with its long tube presents potentialities for evil which must be closely watched. Let the buoy but get clear of the deck and the fall tackle get jammed, and there would come into being a three-ton pendulum with an iron flail, thirty-six feet long, capable of smashing the boat to bits and certainly of sweeping broken-boned men about the deck with no more effort than if they were so many flies.

When the new buoy is safely into the water and its anchor and chain tossed after it, the unusual spectacle is presented of two whistling buoys, side by side. But the new buoy is silent.

"Lazy—doesn't want to work," say the sailors. But it is only waiting until the water has filled its long tube to take up the burden of its mournful song—a sound so indescribably melancholy that the department has always scores of protests from land dwellers when one of these sirens is placed within sounding position.

But if getting the new buoy overboard is dangerous work, hauling the old one in is more so. The buoy is first secured by good seamanship, managing the steam vessel, with a rope through the iron cage at its top. Working from this, ropes, chains and "springs" or heavy cables are brought into play and the whole very cautiously lifted and secured as it comes over the side. It is allowed to swing free not at all, save perhaps for an instant, just as it is laid flat on the deck, and then, apparently in the very face of death, a dozen men spring at the mass, ready to swing with the waves and to demolish them, and thrust huge billets of wood underneath its sides, to hold it long enough for lashings to make it secure. The boat, being belayed to the anchor chain, then cautiously backs away to raise the anchor, perhaps buried for months in the mud, and there is a general scampering away from the cable while this is being done, as should it break it would be like having a couple of cannon balls come tearing along the deck; a breaking two-inch cable is as rigid as an iron bar and with hundreds of tons of force in its swift flick through space.

However, so skillful are these handlers of heavy masses of iron on an unstable keel, that it is rare that an accident happens, while most of those which occur to whistling buoys are caused either by their being run down and their tubes cut off by the propellers of large vessels or by their being damaged by ice.



A monster whistling buoy, which has been damaged by being struck by an ocean liner. Tube cut in half by propeller blow.

Rope Shoes for Horses

IN Germany many horses are being shod with shoes made of tarred rope. The object is to prevent slipping on streets covered with asphalt or paved blocks. In some of these shoes there is also a block of wood, into which stiff bristles have been driven. This is an additional preventive against slipping, and strengthens the shoe. They are light and comfortable for the horse, and deaden the sound of the hoof.

READERS are invited to contribute to this department photographs of novel and curious objects, unique occurrences, and ingenious contrivances. Such as are available will be paid for promptly.

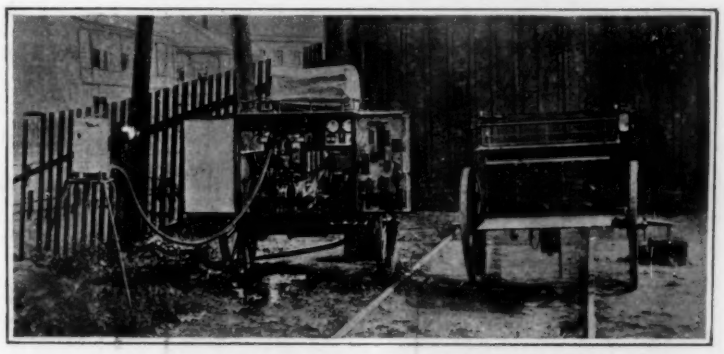
Aeroplane Vans for the French Army

SOME time ago we called attention to the horse-drawn vans that were being used by the French army for the transportation of aeroplanes. The French War Department is now making use of automobiles for this purpose, and our illustration shows a number of motor vans with their trailers used for the transportation of an *esquadrille* of aeroplanes. The aeroplanes are dismounted and placed in the trailers, and the motor van is used for the transportation of spare parts, etc. Each *esquadrille*, consisting of from six to eight aeroplanes, has a couple of machine-shop repair trucks such as we illustrated a few weeks ago. These trucks have sides which open and form work benches, while they are fitted with all the necessary lathes and machine tools used for the repairing of aeroplanes. The new motor transport vans effect a great saving of time in the moving of aeroplanes from place to place when it is not desired to send them by the air route.

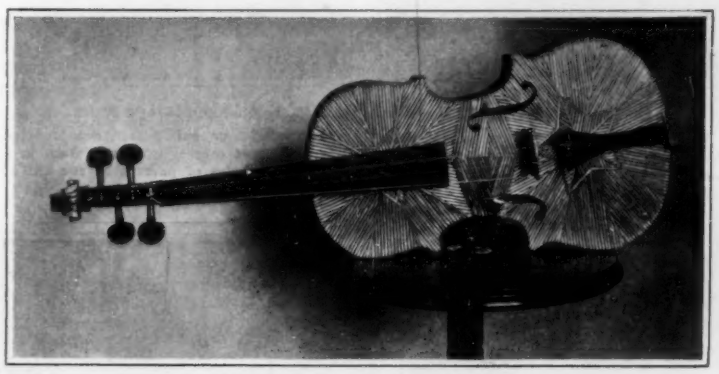
Motor vans and trailers for French army aeroplanes.

A Violin Made of Matches

THERE are certain individuals who have a penchant for putting to curious use, materials that others consider worthless. Thus a man will make a clock out of bits of straw or a cane out of old newspapers. Here is a picture of a violin, the body of which was built of matches. A man living in Bay City, Wisconsin, conceived the novel idea, and spent a year in the painstaking operation of constructing a musical instrument out of the refuse of the match-box. "The instrument contains 5,450 matches," says the man who sent us the photograph, and he also assures us that the violin has "a full, sweet, mellow tone," which, if really so, strikes us as even more remarkable than its peculiar construction. The instrument has been on exhibition at the Minnesota State Fair, where it attracted a great deal of attention.



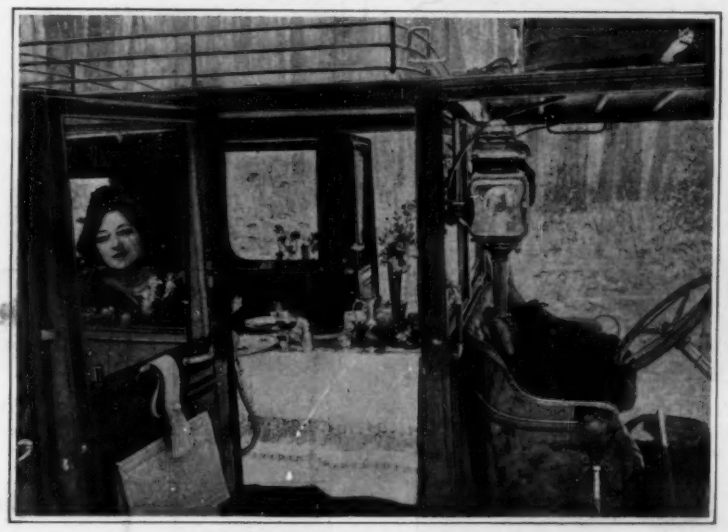
Austrian army ultra-violet sterilizer filling a water tank.



A violin built of 5,450 matches.

The Acme of Car Luxury

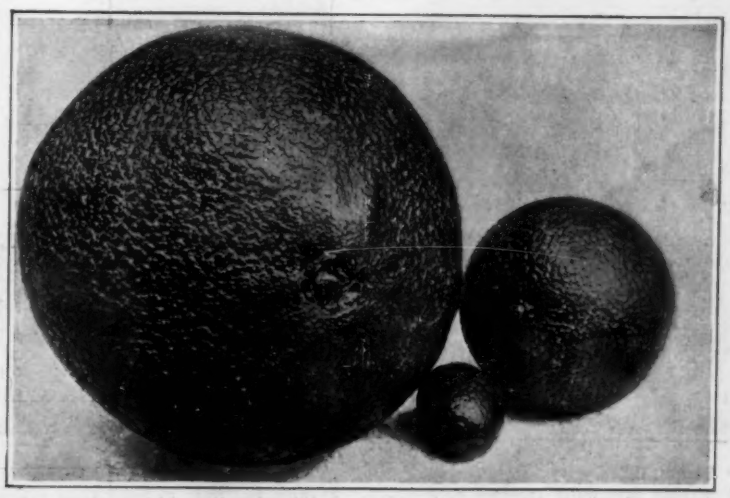
IN order to travel with all the conveniences of the twentieth century, and even to dine in privacy *en route* without being compelled to leave her car, a German singer of note has ordered a traveling limousine which must be considered the acme of luxury. As the illustration shows, it can be converted into a dining room, completely and luxuriously fitted. By a few deft touches it can be transformed into a "boudoir," card-room or bedroom. The seats are adjustable so as to form a broad and comfortable davenport bed.



A limousine converted into a dining car.

Girdling Orange Trees

PICTURED herewith is a Washington navel orange weighing 3¼ pounds and measuring 18 inches in circumference, which was grown by Mr. Robert Howe in Orlando, Florida, in 1892. Beside this giant specimen may be seen a kumquat and a nonpareil. Mr. Howe had a number of Washington navel trees, which bloomed more profusely than any other variety, but would not hold their fruit, producing an average of one box per tree. In the spring of 1892, just when the fruit began to appear he girdled the trees, taking out a strip of the bark about ⅛ inch wide. The result was a yield of from eight to ten boxes per tree, while a large majority of the oranges were of an enormous size, but thin-skinned and full of juice. Some of the largest were displayed in the "Florida on Wheels" exhibit, a car loaded with Florida products that ran all over the Northern States. The trees were girdled again the next two years and gave a full crop, but the fruit was all of medium size. In February, 1895, all the trees were killed by frost. Grape vines, apple trees and the like are sometimes girdled to obtain larger fruit, but this is usually attended by a diminution of the quantity of the yield. Such was apparently the case with Mr. Howe's orange trees; for as the size of the fruit diminished in successive years the quantity increased.



Giant orange produced by girdling, compared with a nonpareil and a kumquat.

Ultra-violet Light Sterilizer for the Austrian Army

THE new French ultra-violet ray water purifying apparatus has been made up in portable form and is now being tried out by the Austrian army upon its first trials. As the apparatus is intended to be used for a supply of pure drinking water for troops in the field, it is a complete plant, containing its own machines for operating pumps and producing electric current so that it can be set up at any point on the field. When on the road, the small front truck containing the driver's seat and also a supply box is attached to the apparatus proper, which is mounted in the rear box upon a two-wheeled truck. When on the spot, the rear box is detached and opened up, and the sterilizing tank removed and set up on a tripod support so as to be within easy reach of the troops. Within the case is a well-designed plant consisting of a small gasoline engine coupled to a rotary pump and also to a dynamo. A hose leads from the pump to the source of water supply, such as a well or pond, and the water is pumped up and sent directly into the sterilizing tank if it is quite clear, or if not it passes first through a rapid filter. A short piece of hose connects the plant to the sterilizer, and electric wires also make connection with the dynamo so as to supply the mercury vapor lamp. A set of instruments serve to give the proper amount of electric current, and automatic devices cut off the current when the water is not flowing out of the tank, in which case automatic valves also stop the water supply from the pump. The present apparatus is likely to be valuable in keeping up the good health of the troops, as when on the field the water is often taken from polluted sources, and this is recognized to be one of the main causes of disease. Researches made at the laboratories of the Paris University by Prof. V. Henri show that provided it is so clear as not to prevent the ultra-violet rays from penetrating below the surface, water which is heavily charged with coli bacillus and other most dangerous microbes, is rendered quite harmless. Such microbes are, in fact, entirely destroyed by the powerful action of the rays, as is shown by numerous analysis.

Artificial Marble

THE artificial, or stucco, marble is in the main part composed of gypsum, which should be hard, so that the product can be smoothed and polished. To the finely powdered and sieved burnt gypsum marble dust is often added and the mixture gaged with water in which mucilage has been dissolved. The colors and the streaks or veins, the able imitation of which is the main object in the manufacture of artificial marble, are added to the dry mixture, as mineral colors, or during the hardening of the finished product upon its surface by aid of chemical compositions.

To obtain streaked slabs large balls of gypsum are kneaded with smaller ones of different colors, and from the ball so obtained thin slabs are cut, which are laid upon the still damp base and then subjected to high pressure. After hardening the slabs are planed. To avoid this toilsome operation of planing, a sheet of glass, highly polished and rubbed with oil, is used. Colored lines representing the veins are traced upon this sheet; then a ¾-inch layer of a thick mixture of gypsum of the desired color is carefully poured over the glass and left to harden. After hardening the slab is carefully removed, and the surface next to the glass will be found to be absolutely smooth, and need no planing.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Wanted: A New Patent Office Building

MUCH has been written and printed recently with regard to certain needs of the patent system of the United States, and a bill for the complete revision of the patent laws has been before the Committee on Patents of the House, ever since April 12th, 1912. Whatever may be the arguments for and against this proposed revision of the patent laws and its consequent effect upon the industries of the United States, there can be but one side only to another important need of the United States Patent Office. This is the need for a new and modern building to accommodate the working force of the office and to provide adequate and fireproof storage for the priceless records of more than one million patents.

Uncle Sam has a good paying business in the United States Patent Office. He makes so much money there that after paying for every conceivable expense in the issuance of patents, including the salaries of the examiners and the clerks, he can count the handsome profit of more than seven millions of dollars on deposit in the United States Treasury. But what would you think of a business man who made a profit year after year, a gradually increasing profit, and who used it for his own benefit, or piled it up in the bank without putting some of it back into the business in the shape of improved facilities? It is evident that such a man could not go along very far without meeting a great slump in his business. Having something in the way of a monopoly in granting patents, however, Uncle Sam pockets the profits and lets the inventors and the Patent Office employees get along as best they may. It is true he did have a burst of generosity about four years ago and raised the pay of his examiners. That was done, however, because there was a constant procession of examiners through the office, and resignations to go elsewhere and get more pay came so fast that the Commissioner felt that he could scarcely recognize half of his employees by sight and much less call them by name.

The appointment of Commissioner Moore in 1907, however, started the ball to rolling for newer and better things. The salaries were raised and the examining corps placed upon the highest state of efficiency possible with the present salary rate. True, there are resignations now—law firms and corporations are always looking for trained men—but the difference between the Patent Office salaries and the inducements offered is not so great now and more men stay in Washington to perfect themselves in the knowledge of patents and patent law.

This feat accomplished, one would suppose that Mr. Moore was content to rest on his laurels. But not a bit of it. Scarcely had he executed this task safely than he began banging on the doors of Congress for money to improve the Patent Office building. Business was good, plenty of money was coming in, and the employees were satisfied, but Uncle Sam still clung to his old-fashioned, thoroughly obsolete building.

Issue and Gazette Division.

Where the completed patents are prepared for issuance. Note the crowded desks and walls occupied by open shelves on which are valuable documents.

A cell-like storage room.

No sunlight or outside air ever reaches this place; yet copy-pullers must work here getting out copies of patents by the aid of artificial illumination.

Patent Office Court.

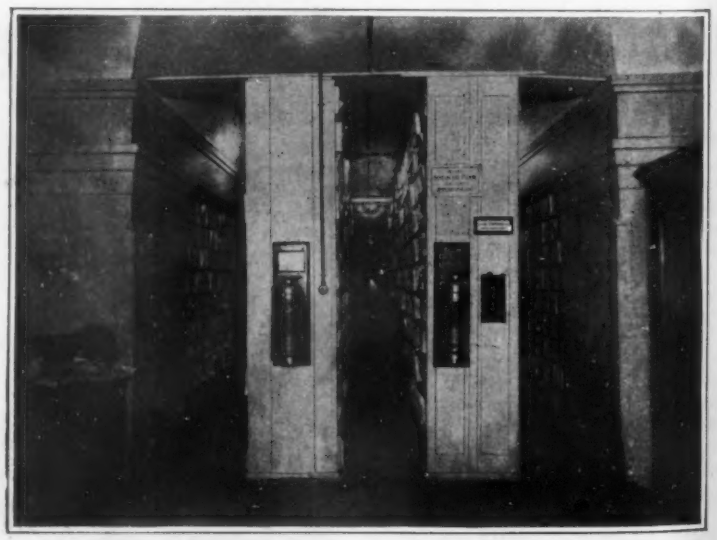
A breathing space which must be sacrificed for a much needed addition because Congress will not permit the use of the Patent Office surplus to erect a modern building.

A corridor view.

A copy-puller on the left. Copies of patents stored between two outer doors, where street dust reaches them constantly.

The paste room of the Patent Office.

Here copies of patents are assembled. This is a room into which sunshine never pentrates.



A corner where dust accumulates.

Showing temporary shelving where patents are exposed to dust from the street in a basement corridor.

The SCIENTIFIC AMERICAN has repeatedly called the attention of its readers to the urgency of this need. It has published extracts from the Commissioner's reports in which he has sturdily fought for the permission of Congress to either modernize the present structure or to build an entirely new and up-to-date building and business equipment.

Now the idea is not, as might be supposed, to spend money on a showy and ornate building for the benefit of sightseers in the Capital City. No such use of the public's money is contemplated. The need for a new Patent Office building is a real one, not purely a craze for showing off. It might be said, by those who are accustomed to see working people huddled together in lofts and dark holes and corners toiling for their daily bread, that the present Patent Office is far better than the quarters in which some people have to work. And it is possible, too, that the employees could get along, working ten or twelve in a room, or in rooms where the cubic-foot supply of fresh air is far below the standard set by the laws of health. There are plenty of precedents for such conditions. But what about the records of the office? If common humanity toward employees is not a moving reason, there is a still more serious one at hand. If it were not for the gravity of the situation, it would be laughable to note some of the expedients adopted in the cramped quarters allotted to the Patent Office, quarters in which human beings must work, desk by desk, cheek by jowl, occupied in important technical work, nerve-racking and brain-tearing, and in which precious papers and documents are piled from floor to ceiling, gathering dust and dirt. It is as if a house had no closets and all the family's effects were strewn about willy-nilly.

This is a condition which should and does concern the people at large. They are directly and personally interested in the records of the Patent Office. The destruction of valuable assignments of patents, whereby the titles to inventions are held, might mean the loss of millions of dollars to the commercial world, and deal a staggering blow to the nation's business integrity.

Every week an average of nearly a thousand patents is granted. Every week space must be found for the records in these cases. They must be kept conveniently, too, because they constitute works of reference, and are consulted daily. Then, too, space must be found for the printed copies of the patents. More than a million United States patents have been granted, and copies of these are sold every day of the week. These copies must be so conveniently disposed that when an order for a single copy or a hundred copies is received by the office, the "copy puller" can go directly to the place of storage and extract the copies. A large force of boys is actively engaged in this work, and considering the makeshifts which are resorted to to find storage space, their work is anything but pleasant. The corridors of the Patent Office are banked high with copies of patents on wooden shelves, where they are exposed not only to dust and dirt, but to fire also. This danger of destruction by the last is an ever-present one. A cigar or match or cigarette carelessly tossed away might start a conflagration that would be difficult to check before it accomplished great destruction.

Aside from untiring vigilance, the one way to prevent this is by the construction of a fireproof modern building for the Patent Office. The proposal to do this has been repeatedly urged upon Congress by the Commissioner of Patents in his reports, and before the committees. Bills have been introduced which had as their aim this important measure, but a champion of this measure in the halls of Congress has yet to be discovered. This puts the matter squarely up to the Congress, and is a poignant example of the penny-wise, pound-foolish policy of the present day. Economy is one thing, and neglect is another. So far as the Patent Office is concerned, the attitude of Congress has been extremely negligent. The members overlook the fact that the Patent Office is a self-supporting bureau. Little question would arise as to the propriety of building a new post office in a town where the business had long since outgrown its existing quarters. Why, then, is the building of a new Patent Office looked upon with such indifference? All Congress has to do is to authorize an expenditure out of the present surplus in the Treasury which has been earned by the Patent Office—a sum of money which has been paid in by the inventors of the country, and which represents the net earnings of the bureau.

The proposition is one of business, purely and simply. It is not good business to display your wares in ugly surroundings; it is very poor business indeed to hang on to your profits, when their judicious investment would be sure to bring in more and better business. The lack of money has resulted in poor internal facilities in the Patent Office; and these same facilities have resulted in an output that is not as perfect as it should be. Of course, enormous improvements in system have been accomplished in the past few years, but perfection can hardly be hoped for among the present surroundings and the restricted facilities now existing.

"Give us more room" is the continual cry of the heads of the examining divisions, and the Commissioner is helpless to relieve the situation. He has partitioned off the last available inch of corridor, crowded in the last possible desk or filing case, and cleaned up the last adaptable cellar or vault to make it fit for workers and documents. He has succeeded in getting into the sundry civil appropriation bill this year an item which contemplates building an addition to the present structure, a make-shift which is far better than none, but pitifully inadequate when the great needs of the office are considered. This addition, if the appropriation is allowed, will occupy the greater part of the interior court of the present building. This court is a small park, a breathing place for the employees, and its loss will not add to the light and ventilation of those rooms which face on the court. It was necessary, however, to make this sacrifice in view of the refusal of Congress to consider a measure for an entirely new building. But this is merely staving off the inevitable. Sooner or later a new and modern building must be provided. At the lowest estimate it will take five years to build such a structure.

At the hearings before the Senate Committee on Appropriations upon the item proposing to spend $220,000 for a building to be located in the interior court of the Patent Office, Commissioner Moore stated some very plain facts as to the insanitary conditions of the building, and also the grave danger which threatened the records. In this he was backed up by Dr. Warren of the Public Health and Marine Hospital Service, who stated that the cubic feet of air space for each employee was only one third of what it should be, with no possibility, under existing conditions, of remedying this condition. Senator Gallinger asked him whether he thought the Patent Office was a "tuberculosis factory," and Dr. Warren replied in the affirmative, and deplored the fact that little boys of sixteen years of age were forced to work in these dusty and ill-ventilated holes and corners, where stacks of files cut off both light and air.

Senator Warren, the chairman of the committee, was of the opinion that the records of the Patent Office were about as safe as a haystack would be in a forest fire, and added: "It just reminds me of an old-fashioned farm barn, when they stuff the scaffolds and the bays, as we call them, and then the forage or produce gets into the stable room, and there it is, all over every place."

It must not be supposed that the Patent Office is not kept clean. Vacuum cleaners are used and everything is carefully gone over frequently, but when things are exposed constantly, dust and dirt rapidly accumulate and the most careful "house-keeping" cannot keep up with the abnormal conditions.

You who live far from the capital of the nation know little of the difficulties which beset those who are placed in administrative positions. Public buildings in great numbers there may be, but each one represents a struggle with Congress that has caused more than one official to give up in despair. High rents are paid for inadequate working quarters year after year, when a lump appropriation at the start would furnish space a-plenty and comfort for all time.

It is easy to set down facts, but hard to drive them home to those whose interest is courted. Every man who reads these lines ought to feel his personal interest in the matter of the Patent Office. Even if you are not an inventor, you may become one at any moment. Even if you never do, nor never intend to, you are a consumer, and as such profit by the inventions of others. If the patent system of this country were not so excellent and so wisely founded, many of your daily necessities would be yet unborn. For aught that is known, Edison, Maxim, Marconi, Morse or Westinghouse might never have had that incentive which is furnished by the protective patent laws of the nation.

What are a few hundred thousand dollars, or even a couple of million dollars compared to the commercial supremacy and perpetuity which depend upon the United States Patent Office?

Let the reader try to understand the simple statement, made as clear as possible, viz.: The Patent Office has earned the money; it has the money; only Congress can give the authority to spend part of it for a new building to take the place of the old structure it now occupies; Congress refuses. Result: Employees are unable to work under the best conditions, necessarily affecting the output of the office, and invaluable records are in danger of gradual destruction from exposure, or sudden destruction by fire.

Ignorance may be as largely responsible as indifference for the conditions which exist, but to be fore-warned is to be fore-armed, and it cannot be charged against the present administration of the United States Patent Office that it has failed to persistently call attention to existing conditions.

The American Patent System

RESOLUTIONS ADOPTED BY THE BOARD OF DIRECTORS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

THE numerous bills now pending before the Congress and greatly modifying the patent system in the United States, have received the attention of the American Institute of Electrical Engineers. Recognizing that the patent system has been, and is, a tremendous factor in building up the present industrial prosperity of this country, thereby greatly contributing to the prosperity of the country as a whole, and that any untoward change in the patent situation might disastrously affect this condition of industrial and general prosperity, and the conditions contributing to their continual augmentation, the Institute has passed resolutions, the more important of which are the following:

"Whereas, in view of the intimate relation of the Patent System to the general welfare, no action looking toward any radical change in the Patent System should be taken without most careful consideration, and

"Whereas, in our opinion, proper consideration of such important changes as are proposed can be had only by an unbiased, non-partisan commission, made up of men from various walks of life and not from any one vocation, or interest.

"Be It Resolved, that the American Institute of Electrical Engineers, acting through its officers and board of directors, respectfully urge the Congress of the United States that they provide for a commission, made up of unbiased, independent, non-partisan men of such national standing as will command the respect of the whole country; and chosen from different walks of life; and not more than one from any one calling or interest; and serving without pay. Such commission to hold public hearings, and otherwise, as may appear to them best, to make a thorough and careful study of the American patent situation, and to prepare and submit a comprehensive report and recommendations to Congress for such changes, if any, as may, as the result of their study, appear to them expedient, whether in the Patent Office, in the method of court procedure, or in the organic patent law, and recommendations as to the legislation they would propose for effecting said changes. And that we further respectfully urge that the Congress make ample provision for the expenses of said commission, and

"Be It Resolved, that we respectfully urge the Congress of the United States to hold in abeyance all proposed legislation affecting the Patent System in whatsoever way until such time as the said commission shall have had ample opportunity to hold the said hearings, and make the said study and report, and

"Be It Further Resolved, that these resolutions be printed and a copy be sent to each Senator and Representative of the United States who is a member of the Senate or House Committee on Patents."

Notes for Inventors

Five United Shoe Machinery Company Patents.—The United Shoe Machinery Company, as assignee of Frederick M. Furber of Haverhill, Mass., has just secured four patents, Nos. 1,043,083 to 1,043,086, inclusive, for cementing machines and a patent, No. 1,043,087, for device for applying liquid to shoes or other stock.

Improved Tire Fabric.—Harry K. Raymond of Akron, Ohio, assignor to the B. F. Goodrich Company, has secured a patent, No. 1,043,143, for a tire fabric which includes a strip of woven rubber-treated fabric composed of a plurality of sections arranged bias with the transversely extending edges of each of the sections provided with a series of tongues overlapping and secured to the adjacent section.

The Real Inventor of the Telescopic Spectacles.—In the SCIENTIFIC AMERICAN of November 23rd, 1912, we published an article by Dr. L. K. Hirshberg on "The Telescopic Spectacles." The author gave credit for devising the telescopic spectacles to Dr. K. L. Stoll, whereas Dr. Stoll was simply the first to demonstrate them in this country. Since this places Dr. Stoll in an embarrassing position, we call attention to the fact that the discovery is to be attributed to Prof. E. Hertel, formerly of Jena, but now of Strassburg, Germany.

A Hand-operated Knot Tier.—In patent No. 1,041,039, John T. Dalton and John Clayton Daneker of Baltimore, Md., present a hand-operated knot-tying implement which includes a pair of pivotally-connected levers with a knotter and a gripper carried by one of the levers and means carried by the other lever for operating the knotter and a cam carried by said other lever for operating the gripper.

Chemical Vessel to Withstand High Temperatures.—Byron E. Eldred of Bronxville, New York, who has assigned to the Commercial Research Company of New York city, has secured patent No. 1,043,579 for a chemical vessel or crucible in which there is a core layer of ferrous metal which is completely enveloped and hermetically sealed in by a surface layer of a noble metal with the surface layer welded to the ferrous metal.

Two Peter Cooper Hewitt Patents.—The Cooper Hewitt Electric Company of New York, as assignee of Peter Cooper Hewitt, has secured patents No. 1,043,104 and 1,043,766. The former includes the combination with a plurality of oscillatory circuits of the same periodicity and means for charging said circuits independently and means so that the circuits are discharged according to a predetermined time relation with the discharge periodicity of each of the circuits, a multiple of the periodicity of the charging voltage. In the patent No. 1,043,766 is described the method of generating high frequency currents of impulses which consists in charging a plurality of oscillatory circuits and discharging said circuits successively.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

HOLDER FOR COWS' TAILS.—W. M. UNDERHILL, Oconto, Wis. Numerous objections are overcome by the use of this improvement. The holder being loosely suspended from overhead, the cow is free to move her tail, and by reason of the fact that the tail cannot be switched from side to side below a certain plane, all inconvenience and annoyance to the milker is obviated.

Of General Interest.

MARCEL WAVER.—J. W. BUICKEROOD, 26 2nd St., Boundbrook, N. J. This improvement pertains to toilet articles and especially to devices used in dressing the hair, the special object being to provide a waver of a cheap and simple nature and which may be used rapidly and with the highest degree of satisfaction and without injury to the hair.

DAVIT HOOK.—C. A. PETRIE, 700 Lime St., St. Johns, Newfoundland. This improvement relates to a ship davit hook for use in lowering and hoisting life and other boats. It provides a hook particularly adapted for use at the end of a boat raising tackle, constructed to automatically disengage itself from the boat ring as the boat strikes the water.

FORESIGHT FOR SMALL ARMS.—R. DE BERTOUCH, 27 Scarsdale Villas, Kensington, London, England. The invention relates to foresights for fire-arms of all kinds and the object is to obviate the difficulty which the user of a rifle, pistol or like weapon often experiences in distinguishing the foresight, especially when firing rapidly or under unfavorable conditions as regards sighting.

APPARATUS FOR REGISTERING THE CONSUMPTION OF LIQUID FUEL.—R. F. O. CHAUVIN and R. ARNOUX, 186 Rue Championnet, Paris, France. The object of this invention is to provide a controlling apparatus for registering the quantity of liquid fuel consumed by thermal motors, as for example the quantity of petrol (gasoline) consumed by an explosion engine, and under conditions which will render fraud impossible.

COIL PROTECTOR.—H. E. BAILEY, 64 Lodge St., Albany, N. Y. This invention relates to refrigerators used for cooling beer and other liquids immediately previous to dispensing the same at a bar or the like. It provides a protector arranged to protect the coil in the refrigerator cabinet or casing against injury when packing ice into the opening of the coil and around the coil within the cabinet.

NURSING BOTTLE SUPPORT.—W. H. SAUNDERS, 507 W. 46th St., Manhattan, N. Y., N. Y. This invention particularly relates to a means for supporting the bottle on the side of a child's crib or carriage, and an object is to dispose the bottle within reach of the child and a further object is to provide a support which may be readily removed from the crib or carriage.

Machines and Mechanical Devices.

CAP FEEDING MECHANISM.—A. JOHNSON, 14 Dunham Place, Brooklyn, N. Y. This mechanism is especially adapted for use on bottle capping machines, and the principal object of the invention is to provide a construction whereby the caps will be fed to the cap-affixing mechanism in proper sequence and in correct position.

MACHINE FOR BENDING LUG STRAPS.—G. F. IVEY, Hickory, N. C. This invention provides for bending wooden lug straps for picker sticks of weaving looms; and provides a method of bending wooden strips to form lug straps to avoid splitting or marring the surface of the strips.

HEMMING ATTACHMENT FOR SEWING MACHINES.—W. NICHOLSON, care of Eloesser, Heynemann & Co., 77 Battery St., San Francisco, Cal. The purpose of the invention is to provide a hemming attachment for sewing machines, arranged to permit of accurately passing the material through the scrool to insure the proper formation of the hem, even if the material is provided with cross seams or other thickened portions.

VALVE.—J. J. MEYER, 366 Lenox Ave., New York, N. Y. This valve or ball cock is arranged to insure an easy opening and closing of the valve, to present a different portion of the surface of the valve disk for contact with the valve seat at each operation, and to insure long life to the valve, also to prolong the period of repairing or rewashering thereof and to prevent waste of water by leakage.

Designs.

DESIGN FOR AN AUTOMOBILE LAMP.—A. E. MOODY, 254 W. 92d St., Manhattan, N. Y., N. Y. In this ornamental design for an automobile lamp, the upper and light reflecting part is of round construction, and is seated on a base from which tapers the connection portion.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

PATENT ATTORNEYS

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AGENTS WANTED

AGENTS—Ask us about our snappy household specialty line that will clear you $50 to $80 weekly. American Aluminum Co., Division 1029, Lemont, Ills.

FREE SAMPLE goes with the first letter. Something new. Every firm wants it. Orders from $1.00 to $100.00. Nice pleasant business. Big demand everywhere. Write for free sample. Metallic Mfg. Co., 438 N. Clark, Chicago.

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RADIUM! A few dollars will get enough for many interesting experiments. A nice piece of Radium ore to make radiographs, 50 cts. Radium Bank, Grand Junction, Colo.

PATENTS FOR SALE

PATENT on improved table caster. Provides for carrying flasks arranged to normally conceal the holders. Ingenious table novelty. For particulars address "Caster," Box 773 New York City.

PATENT on skirt marker for sale. A woman in a few minutes can mark her own skirt length and trimming with ease and accuracy. Address Anderson, 267 51st St., Brooklyn.

INSTRUCTION

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MISCELLANEOUS

MODEL AND FINE CLOCK TRAIN WORK. Estimates given. Work done by the hour or by contract. Waltham Clock Company, Waltham, Massachusetts.

UNITARIAN LITERATURE SENT FREE upon request. For full particulars please communicate with Mrs. C. P. Seagrave, No. 4 Catalpa Road, Providence, R. I.

DAIRYMEN. Let us tell you how to keep your barn cleaner with less work—get more and better quality milk—keep cows cleaner, healthier—prevent disease. James famous Sanitary Barn Equipment fully described in our two free books. Write postal or letter request *now*. James Mfg. Co., J 70 Cane St., Ft. Atkinson, Wis.

INQUIRY COLUMN

Inquiry No. 9288. Wanted the names and addresses of concerns that can coat steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9289. Wanted substance melting at 225° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapor.

Inquiry No. 9290. Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with minor coins in a pay envelope of the usual size.

Inquiry No. 9291. Want to buy machinery for manufacturing wooden tooth picks.

Inquiry No. 9292. Wanted a gum that will stick labels to grape-fruit;

Inquiry No. 9293. Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth.

Inquiry No. 9294. Wanted to buy glass balls 1½ x 1¼" in diameter.

EPICYCLIC TRAINS, which play an important part in toothed gearing, are ably described in Scientific American Supplement 1524. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

A Mechanical Bill Counter

(Concluded from page 508.)

to which is attached a bell which rings whenever a count is made. Should the current go through the paper for any reason—as sometimes happens in counting money fresh from the laundry which is still damp—the doors do not fly up and the bell refuses to ring, and the attendant is thus warned that the bill is not counted. She then slips it through a second time, or she can lay it aside until dry, substituting a dry bill. It is because of this dampness of the bills that the money counting machine is installed in the laundry room, in order to give it the most severe test possible.

But the greatest feature of this machine is not yet told. If in a pile of money there are, for instance, one dollar bills, five dollar bills and twenty dollar bills, it is impossible to count them by "ruffling" the bills and "walking" the fingers through the pile, dividing them into mentally counted sets of four or five—the way piles of bills of one denomination are counted by hand. Such a mixed pile must be separated into its component kinds, a separate count then being made for each kind, involving one count for each kind, as well as a separating count.

But with the Buckley counting machine, all this extra work is obviated. The girl tending the machine simply feeds all the "ones" in the one box, the "fives" in the five box, and the "twenties" in the twenty box, and the machine counts each boxful separately and prevents her from putting more than a hundred bills in a pile without a separator between the hundreds. Should there be ones, twos, fives, tens and twenties in a pile, a machine with five counters and five magazines will do in one operation what the human counter must do in six operations!

The machine absolutely relieves the operator of mental strain. She does not count the bills, merely feeds them into the machine. An expert is able to do this at an average speed of 5,000 bills an hour, or 35,000 bills a day. A speed of 15,000 bills a day by mental counting is considered highly expert work. To go faster means liability to errors and great weariness on the part of the operator.

With mixed piles of bills, the machine will count in hundreds of thousands of dollars where the human counting machine will count in thousands, simply because it can do at one operation what the human counter must do in several.

Mr. Buckley is now at work on a money counting machine which will be automatically fed, so that one attendant can count bills to the amount of a hundred thousand a day, and perhaps more. This will be on the lines of the present machine with a pneumatic pick up and feeding mechanism on somewhat the same idea as an automatic press feeding machine is constructed. This machine has not yet been completely worked out.

A Great Lake Passenger Steamer

(Concluded from page 513.)

and the cut-off in each cylinder has a range of from one fourth to three fourths of the stroke, adjustable from the starting platform. None of the cylinders are steam jacketed, but together with the two large tank receivers they are well insulated. The crank-shaft is 25 inches in diameter in the engine bearings, 27½ inches in diameter at the outer bearings, and 71½ feet long, from end to end. It weighs 103½ tons. The connecting rods are 20 feet center to center and 13½ inches in diameter at the center of their length, and each weighs 10 tons. The piston rods are 12 inches in diameter. The paddle-wheels are unusually strong and heavy and are designed to successfully meet the severe ice conditions met with in the early part of the season. The centers are of cast steel and the arms of forged iron, with the large gudgeon bosses forged on and bushed with lignum-vitæ. The wheels are 30 feet 3 inches in outside diameter, each fitted with 11 curved steel buckets 14 feet 6 inches long by 5 feet wide and on the outer ends are sup-

Wireless Telegraphy Without Sparks

IN wireless telegraphy, electric oscillations created in an arrangement of conductors, or antennæ, produce electric waves of the same period or frequency in the surrounding ether, through which the waves move with the velocity of light, 300,000 kilometers per second. This length of the wave is obtained by dividing this velocity by the frequency, so that a commercial alternating current of 50 cycles per second would generate aerial waves 6,000 kilometers in length. It would be necessary, however, to employ an antenna 600 kilometers long, as it has not been found possible to construct an antenna capable of emitting waves more than ten times longer than itself. An antenna having a length of 600 meters, which is about the practical limit, would emit waves 6,000 meters long, and would require an alternating current of 50,000 cycles per second.

In practice the high frequency required is obtained by the oscillatory discharge of a condenser through a spark-gap. Some inventors have devised alternators of frequencies ranging from 25,000 to 100,000 which can be connected directly with an ordinary antenna without intercalating a condenser and spark-gap, and other inventors have endeavored to construct, within an area of practicable dimensions, antennæ capable of emitting waves from 30 to 60 kilometers in length, when connected directly with alternators of 10,000 to 5,000 cycles per second, which can already be furnished by electrical constructors. The problem of the suppression of sparks has been treated variously in various countries.

The American inventors, Fessenden, Alexanderson and others, have beaten all records for high frequency alternators. Alexanderson has constructed machines of 200,000 cycles per second, a frequency corresponding to a wave-length of 1,500 meters, which is given many antennæ in actual use. This machine, however, makes 20,000 revolutions per minute and possesses mechanical peculiarities too audacious for practical use, from which its low efficiency (less than 5 per cent) is alone sufficient to exclude it.

The German school appears to have limited the area covered by the antenna to 20 hectares, and the length covered to 1 kilometer. Two solutions of the problem have been found. The Telefunken company has adopted Count Arco's alternator, which has a normal frequency of 50,000 to 60,000, and is capable of furnishing frequencies of 30,000 and 120,000. The power consumed is 25 kilowatts, and the power delivered is variously estimated at 2.5 and at 6 kilowatts. The construction of the machine remains a secret.

Rudolf Goldschmidt has constructed several machines in which the initial frequency of 12,000 is increased to 48,000 by the introduction of condensers and inductance coils, in accordance with a principle enunciated by M. Boucherot in 1893. The efficiency is superior to that of Arco's machine and may possibly be as great as 50 per cent.

In France the problem has been treated in a very different manner. Before attempting to construct alternators of very high frequency it is rational to inquire how high a frequency is desirable. It is possible that an antenna of practicable dimensions might be so constructed as to

ported by a 14-ton steel truss. Steam at 160 pounds per square inch pressure is supplied by six cylindrical return tube boilers. The boilers are placed in two batteries of three each and are fired in a fore-and-aft direction, the coal being carried in three athwart-ship bunkers.

On the owners' trial trip the run from East Shoal to Long Point, a distance of 133¼ miles, was made in six hours and twenty minutes at an average speed of 21.04 miles per hour. On this run, one of the safety valves blew off at 140 pounds, so it is fair to assume that under a full head of steam the "City of Detroit III." can maintain an average speed of well over 21 miles per hour.

emit very long waves and hence to permit the employment of an alternator of moderately high frequency, which would be more efficient, durable and practical than a machine of 50,000 cycles per second. As the product of the frequency by the wave-lengths is equal to the constant velocity of propagation, the diminution in frequency caused by the omission of the condenser and spark-gap can be compensated equally well by increasing the frequency of the alternator, the wave-length of the antenna, or both at once.

The last mentioned expedient has been adopted by M. Béthenod, who has recently devised a very successful system of wireless telegraphy without sparks.

The antenna in sheet form suggested by Blondel in 1903 already makes it possible to produce waves about ten times as long as one of its component wires. It has been learned, furthermore, that wave-lengths of 15 to 30 kilometers, or more, are most advantageous in respect to the reach of a wireless station.

In 1905 Slaby attempted to increase the wave-length of the antenna by introducing capacities and inductances, and made many experiments with antennæ of the sinuous type, but he was unable to arrange his coils and condensers so as to produce the desired result.

In 1908 H. E. Athearn of New York suggested the use of horizontal sheet antennæ of the Blondel type, but with Slaby's sinuous or zig-zag arrangement of wires. An antenna of this sort, however, emits waves of several different lengths, which produce a confusion fatal to practical utility.

Béthenod's method of introducing inductances and capacities gives a wave-length about ten times greater than that of an ordinary sheet antenna carried by the same supports. The wave-length is proportional to the square root of the product of the inductance by the capacity. The difficulty of increasing the inductance and capacity of a system carried by given supports is caused by the formation of nodes at the added inductance coils, so that the wave-length corresponds to a part of the antenna instead of the whole, and consequently is not increased, but is diminished.

Béthenod has discovered the law which permits the simultaneous introduction of inductances and capacities in such a manner that the wave-length is increased. Considerations affecting patents make it impossible at present to give drawings and calculations of the Béthenod antenna.

As a practical example, however, it may be stated that an antenna having a wave-length of 60 kilometers would be less than 1 kilometer long, and would require only 6 or 8 supporting pylons if it were of the Béthenod type, while it would be at least 10 kilometers long and would require 30 pylons if it were of the sheet form actually employed by the English Marconi Company and the German Telefunken and Goldschmidt companies. For a wave-length of 6 kilometers the corresponding numbers of pylons would be 4 and 10.

In view of the facility with which these long-wave antennæ can be constructed and the increased reach obtained by using long waves, it is evident that alternators of frequency greater than 10,000 are not required. A diphase alternator is preferable to a monophase machine. The only objection to the use of diphase alternators, the necessity of employing two antennæ, placed at right angles to each other, has been eliminated in the Béthenod system by a device which reverses one phase before the current enters the antenna.

The new system offers several advantages in addition to those of simplicity and economy. In ordinary wireless telegraphy the principal wave is attended by a train of waves of different lengths, which make accurate tuning impossible, but the sustained waves of the new system, absolutely uniform in length, permit vigorously precise tuning and close approximation of stations without danger of interference. By means of automatic transmitters and receivers a speed of 200 words

per minute can be obtained. This is ten times the speed of a simple Atlantic cable, or six times that of a duplexed cable. Hence, wireless telegraphy without sparks promises to become a formidable competitor of cable transmission. The new system also promises to make wireless telephony practically possible.

A Rule to Find the Day of the Week upon Which Any Given Date in the Christian Era Fell

By John P. Atchley

FOR all dates prior to and including September 2d, 1752 (which are calculated according to the Old Style calendar), divide the number of the years by four, rejecting the remainder if there is any; to this quotient (1), and the number of the year (2), add the number of days up to and including the given date (3), (always counting 28 days in February; and for any date in January or February of a leap year, take, in adding, one less than the total number of days to the given date). From this sum of (1), (2), and (3), subtract a correction of two and divide the resulting number by seven. The remainder left will indicate the number of the day of the week—0 representing Saturday, 1 Sunday, 2 Monday, etc. (Note that every year evenly divisible by four was a leap year under the Old Style.)

Date of Christ's Crucifixion, April 3d, 33.

4) 33
8 (1)
33 (2)
93 (3)

134
2 (correction)

7) 132
18 + 6, or Friday.

Follow the above rule for all dates after September 2d, 1752 (which are calculated according to the New Style calendar), except that instead of subtracting a correction of two before dividing by seven as above, subtract a correction obtained as follows: Take the figures denoting hundreds in the given year and divide them by four; the difference between the quotient thus obtained and the said figures is the desired correction Thus for 1905:

4) 19
4 19 — 4 = 15,

which is the correction for 1905. (Note that under the New Style century years as 1300, 1800, 1900, etc., are not leap years unless evenly divisible by 400, and this correction is to allow for those century years that are omitted as leap years—three of them in each 400 years.

July 4th, 1905.

4) 1905
476 (1)
1905 (2)
185 (3)

2566
15 (correction)

7) 2551
364 + 3, or Tuesday.

The change from Old Style to New Style was made by English-speaking countries in September, 1752, when eleven days were dropped from the calendar and the 3d of that month passed as the 14th. Most dates previous to that time are given according to the Old Style, but some important ones have been changed to the New Style. For instance, Washington was really born on February 11th, 1732, according to the calendar in use at the time.

In Catholic countries the change was made in 1582 by direction of Pope Gregory XIII, when ten days were dropped from October and the 5th of that month passed as the 15th. Dates of events happening in those countries between 1582 and 1752 are sometimes given according to the New Style, and in that case the rule for the New Style would be used.